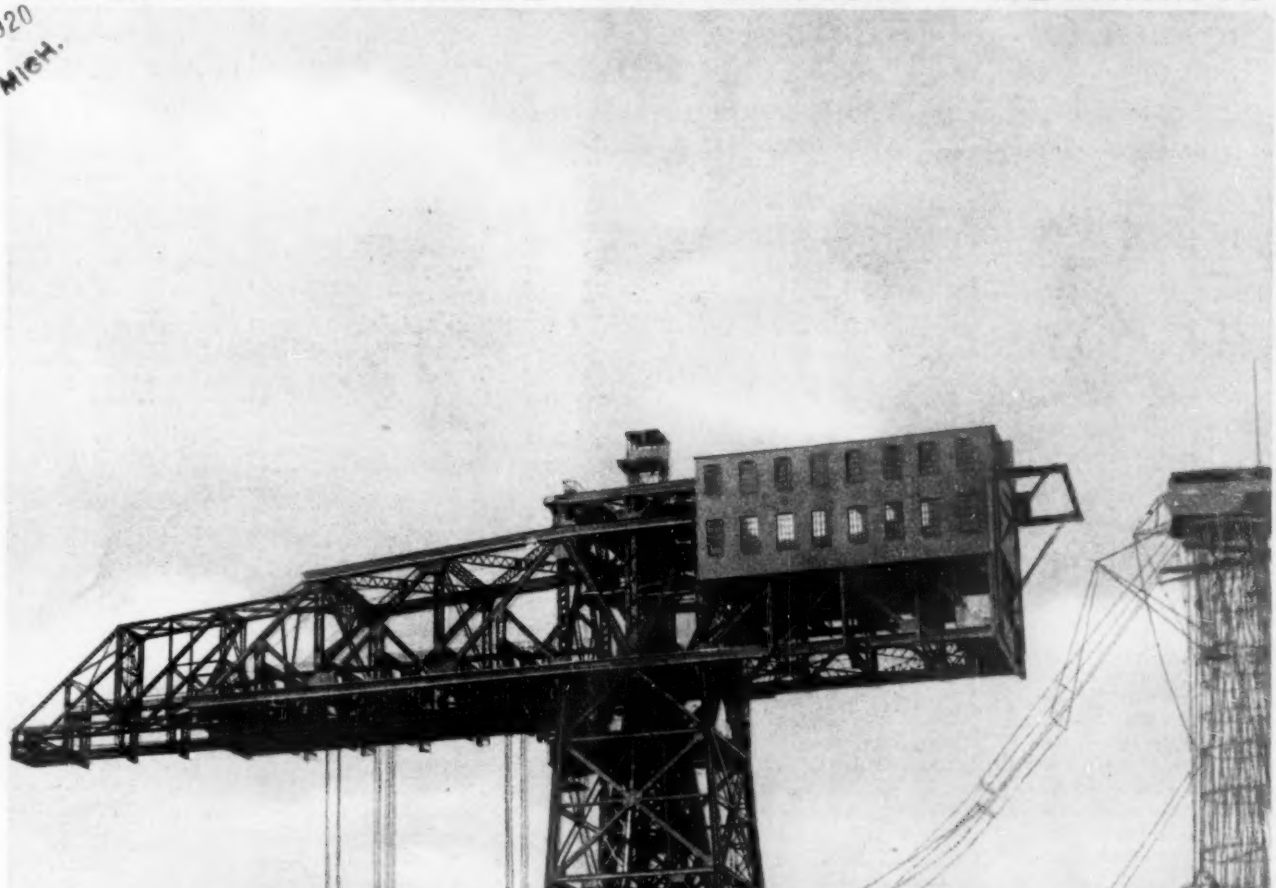
IN THIS ISSUE:

IS THERE A COAL SHORTAGE?
AN ENGINEERING BULWARK

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



THE LARGEST OF ITS KIND: 350-TON CRANE AT PHILADELPHIA NAVY YARD.—[See page 178]

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FIVE OIL MISTAKES

How to stop maintenance dollars from blowing through the exhaust

MOTORISTS are looking for scientific ways to reduce upkeep. Old mistakes—always costly—today positively extravagant—must go.

Here are five common lubrication errors. They are responsible for many of the operating troubles that motorists experience.

MISTAKE No. 1

"Oil is a good thing—you can't have too much of it."

Some motorists believe that if the oil reservoir is filled above the indicated high level, better lubrication will be provided. They are mistaken. Oil should be kept at the proper level—no higher. Over-filling causes excessive carbon, gummed valve stems and sooty spark-plugs.

MISTAKE No. 2

"I use heavier oil because my engine's badly worn."

Many motorists believe that a change to heavier oil is advisable in a worn engine. This is not so. Worn engines need *overhauling*. Heavier oil is no substitute for worn parts. The lubrication system of a car may be wholly unsuited to properly distribute a heavier oil than specified in our Chart of Recommendations.

MISTAKE No. 3

"Old oil never does any harm in the crank-case."

Some motorists neglect to drain the old oil from the crank-cases of their engines at frequent intervals. The correct oil is not destroyed in use. But it does become contaminated with grit drawn in through the breather, with carbon particles from the undersides of the pistons and with water from condensation. It also becomes thinned out with fuel absorbed by the oil film on the cylinder walls, especially when the mixture is too rich. For these reasons old oil should be drained from the crank-case frequently.

MISTAKE No. 4

"When refilling I always clean out my engine crank-case with kerosene.

This procedure sounds logical—hence has come into common use. Experience shows, however, that it is almost always a mistake, for some of the kerosene is usually retained in the splash troughs or other oil pockets in most crank-cases and thus thins out the new oil. The better plan is to drain the crank-case when the engine is hot. This will carry off the sediment before it settles. Then flush out with a quart of fresh oil and refill to the correct level.

MISTAKE No. 5

"My oil seems to work all right."

This, perhaps, is the grandfather of all lubrication mistakes. "My oil seems to work all right" sends more cars to the repair shop than all other causes combined.

The motorist cannot watch from day to day the inside of his engine. Hence he is in no position to know accurately the effects of different oils. While many oils may "seem to work all right," only *one* of those oils may be giving him scientific lubrication. And only that *one* can give him—the lowest fuel bills, the lowest oil bills and the lowest repair bills.

The Chart at the right specifies the grade of Gargoyle Mobiloils which is scientifically correct for *your* car.

The use of that oil and the avoidance of the common mistakes mentioned here will show you *engine results*—economy and power—which you may never have had before.

GARGOYLE

Mobiloils

A grade for each type of Motor

Domestic Branches:

New York	Philadelphia	Detroit	Minneapolis	Kansas City, Kan.
Boston	Pittsburgh	Chicago	Indianapolis	Des Moines

VACUUM OIL COMPANY *Specialists in the manufacture of high-grade lubricants for every class of machinery Obtainable everywhere in the world* NEW YORK, U.S.A.

Chart of Recommendations *for* AUTOMOBILES

(Abbreviated Edition)

GARGOYLE

Mobiloils

A grade for each type of motor

How to Read the Chart

THE Correct Grades of Gargoyle Mobiloils for engine lubrication are specified in the Chart below

A means Gargoyle Mobiloil "A"
B means Gargoyle Mobiloil "B"
E means Gargoyle Mobiloil "E"
Arc means Gargoyle Mobiloil Arctic

These recommendations cover all models of both passenger and commercial vehicles unless otherwise specified.

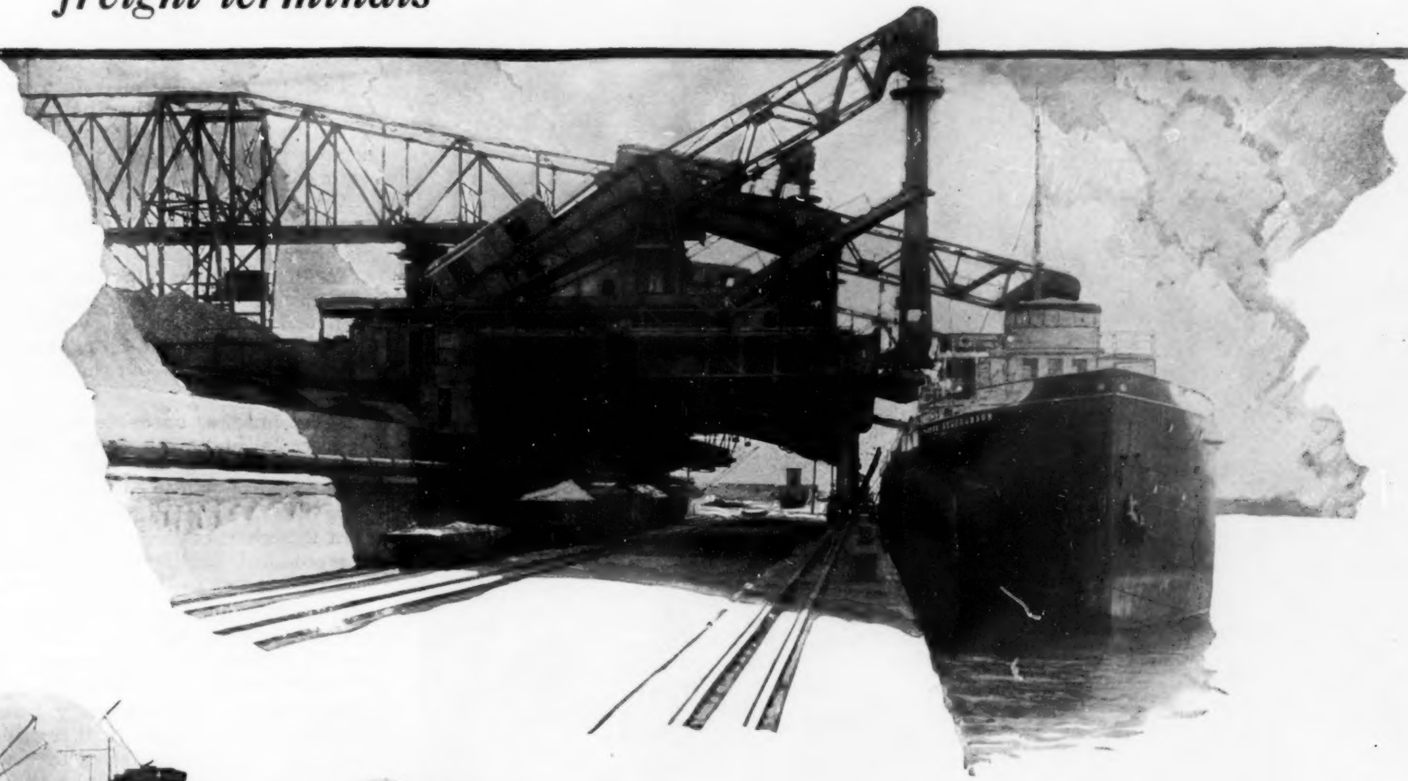
Where different grades of Gargoyle Mobiloils are recommended for summer and winter use, the winter recommendation should be followed during the entire period when freezing temperatures may be experienced.

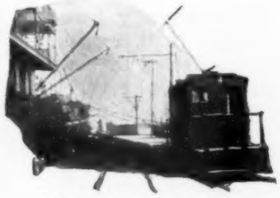
This Chart is compiled by the Vacuum Oil Company's Board of Automotive Engineers, and constitutes a scientific guide to Correct Automobile Lubrication.

If your car is not listed in this partial chart, consult the Chart of Recommendations at your dealer's, or send for booklet, "Correct Lubrication," which lists the Correct Grades for *all* cars.

[illegible] NAMES OF AUTOMOBILES AND MOTOR TRUCKS	1920		1919		1918		1917		1916	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Allen	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Anderson			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Armleder (1 ton)	A	A								
" All Other Models	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Auburn (4 cylinder & 6-39)							A	Arc.	A	Arc.
" (6 cylinder)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (6-39 B) (Teetor-H Eng.)					A	Arc.				
Buick	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Cadillac	A	A	A	A	A	A	A	A	A	A
Chalmers (6-48)									Arc.	Arc.
" (6-40)									A	Arc.
" All Other Models	A	A	A	A	A	A	A	A	A	A
Chandler Six	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Chevrolet (8 cylinder)			A	A	A	A	A	A		
" (F. A.)			A	Arc.	A	Arc.				
" (F. B. & 1 ton)	A	Arc.								
" All Other Models	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Cleveland	A	Arc.								
Clydesdale (120 B)	A	A	A	A						
" All Other Models	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Cole (6 cylinder)									Arc.	Arc.
" (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Cunningham	A	A	A	A	A	A	A	A	A	A
Dodge Brothers	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Elgin	A	Arc.			A	Arc.	A	Arc.	A	Arc.
Essex	A	Arc.	A	Arc.						
Federal (Model S-X)					A	A	A	A		
" (Special)					Arc.	Arc.				
" All Other Models	Arc.	Arc.	Arc.	Arc.	A	A	Arc.	Arc.	Arc.	Arc.
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	A	A	A	A	A	A	A
Garford (3½, 5 & 6 tons)	A	A	A	A	A	A	A	A	A	A
" All Other Models	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Grant (6 cylinder)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (Com.) (Model 12)			A	Arc.						
" (") All Other Models	Arc.	Arc.	Arc.	Arc.						
Haynes (6 cylinder)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (12 cylinder)	A	A	A	A	A	A	A	A	A	A
Holmes	B	A								
Hudson Super Six	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	A
" All Other Models									Arc.	Arc.
Hupmobile	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Jordan	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Jumbo	A	A	A	A	A	A				
King (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Kissel Kar (Model 48)									A	A
" " (12 cylinder)					A	A	A	A		
" " All Other Models	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Kline Kar	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Lexington	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Liberty	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Locomobile	A	E	A	E	A	E	E	E	E	E
Mack (Models AB & AC)	A	Arc.	A	A	A	A	A	A	A	A
" All Other Models									A	E
Madison	A	Arc.	A	Arc.	A	Arc.	A	Arc.		
Marmon	A	A	A	A	A	A	A	A	A	A
Maxwell	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Mercer	A	A	A	A	A	A	A	A	A	A
Mitchell (6 cylinder)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (8 cylinder)									A	A
Moline-Knight			B	A	B	A	A	A	A	A
Moon	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Nash (Quad.)	A	A	A	A	A	A				
" (Model 671)					A	A				
" All Other Models	A	Arc.	A	Arc.	A	Arc.				
National (6 cylinder)	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (12 cylinder)			A	A	A	A	A	A	A	A
Nelson	A	A	A	A	A	A	A	A		
Oakland (8 cylinder)									A	A
" All Other Models	A	A	A	A	A	A	Arc.	Arc.	Arc.	Arc.
Oldsmobile (4 cylinder)	A	Arc.	A	Arc.					Arc.	Arc.
" (6 cylinder)	A	A	A	A	A	A	Arc.	Arc.		
" (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Overland	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Owen Magnetic (Model M-25)					Arc.	Arc.	Arc.	Arc.		
" " All Other Models	A	A	A	A	A	Arc.	A	Arc.	A	Arc.
Packard	A	A	A	A	A	A	A	A	A	A
Paige (6 cylinder)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (Cont. Eng.)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" All Other Models	A	A								
Peerless (8 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models					Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Pierce Arrow	A	A	A	A	A	A	A	A	A	A
" " (Com.) (5 ton)	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" " " All Other Models	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier	A	A	A	A	A	A	A	A	A	Arc.
R. & V. Knight	B	A								
Republic (1½ ton)	Arc.	Arc.	Arc.	Arc.						
" All Other Models	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.		
Reo	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Riker	A	E	A	E	A	E	E	E		
Rock Falls	A	Arc.	A	Arc.						
Saxon			E	E	E	E	E	E	E	E
Scripps-Booth (4 cylinder)					Arc.	Arc.	A	Arc.	A	Arc.
" " (6 & 8 cylinder)	A	A	A	A	A	A	A	A	A	A
Standard Six									A	Arc.
" (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Stearns-Knight	B	A	B	A	B	A	A	A	B	A
Stewart (Buffalo)									Arc.	Arc.
" " (Com.) (¾ ton)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" " (") (1 ton)	Arc.	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" " (") All Other Mod.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Studebaker	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Stutz	A	A	A	A	A	A	A	A	A	A
Templar	A	A	A	A	A	A				
Velie (Model 34)	A	Arc.								
" (6 cylinder)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (Com.) (¾ ton)			A	Arc.	A	Arc.				
" (") All Other Models	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.				
Ward La France	A	A	Arc.	Arc.						
Westcott	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
White (16 valve)			A	A	A	A	A	A		
" (5 ton)			A	A	Arc.	Arc.				
" All Other Models			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Willys-Knight	B	A	B	A	B	A	A	A	B	A
Willys Six	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Winton	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.

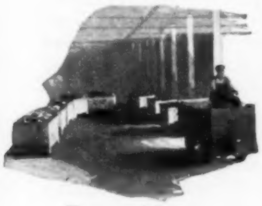
The immediate solution of material handling problems is essential to the efficient development of marine and inland freight terminals



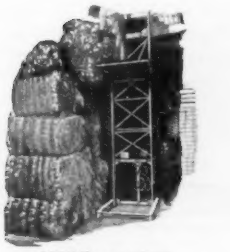


Trolley Type Surface Locomotive works fast between ship and warehouse

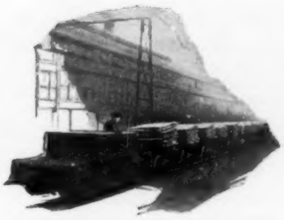
Portable Elevator handling a ton a minute



Tractor and Trailers speed production



1000 lbs. per minute piled from 30 to 50 feet in height



Storage Battery Locomotive hauling 50 tons of copper plates

How electricity improves terminal facilities

THE science of building great ships is not without a parallel science of building equipment to load and unload them. Today, when a big ship docks, a giant power quickly gets under way to clear the hold—this power is electricity applied to large and small material handling devices.

Unloading ore at the rate of fifteen tons per minute is the way the Hulett unloader works for one dock company. For loading and unloading cargoes at ports, the electric crane and hoist prove to be the most economical, most flexible, and most rapid of all machinery. For short distance moving of material, the electric conveyor speeds the work.

Where goods have to be moved greater distances along piers or in warehouses, the storage battery tractor and trailers make quick headway—and portable elevators stack high, neat piles in fast time. In the yards of big industries, electric locomotives simplify transportation problems.

All these devices, electrically equipped and controlled, are busy and consistent factors in conserving hours, and eliminating congestion in handling the world's goods.

Your needs of material handling equipment can best be filled by the manufacturer who, in building his product, obtains the specialized electrical experience and products of the General Electric Company.

General Electric Company

General Office
Schenectady, N.Y.

Sales Offices in
all large cities

43-502

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Putting horse-power over the jumps

THE blasting heat that most of us have felt as a boiler fire door is opened is cool compared to the white hot gases further in, that rise from the incandescent fire bed to be sucked back through the boiler and to the stack.

Their rush is swift, but before they can reach the stack, they have been forced to take the longest and most devious path through great racks of water-filled tubes, so that the water in the tubes will have every possible opportunity to absorb the heat from the gases.

To force them to take this longest path through the boiler, hurdles have been devised by engineers, over which this plunging flood of heat, energy, horse-power, must go, over and under, and up and down.

These hurdles, or baffle walls, as they are called, once presented many difficulties from a structural standpoint. They obviously must withstand great heat. They must be flame-tight, even though necessarily pierced and honeycombed by hundreds of tubes that change size as they heat or cool.

Johns-Manville has introduced a new departure in baffle construction, that of pouring the wall around the tubes just as concrete is poured.

Such baffle walls are really leak-proof and resistant to high furnace temperatures, and unaffected by contraction and expansion of the tubes passing through them. They make new fuel economies possible in steam boiler operation.

This is but one of the many departments of Johns-Manville Engineering in the great cause of power saving. In addition to Baffle Walls, a complete line of *High Temperature Cements* has been developed to protect boiler fireboxes, retorts, cupolas, and dryers, from destruction by high heats.

For the prevention of air leakage or infiltration there are other materials to be applied to the outside of boiler settings—all a most vital work in the conservation of fuel.

Here are a few Johns-Manville products:

Monolithic Baffle Walls
Refractory Cements
Asbestos Insulating Cements
Asbesto-Sponge Felted Pipe Insulation
Asbesto-Sponge Felted Sheet and Block Insulation
85% Magnesia Pipe Insulation
85% Magnesia Block Insulation
Built-Up Brine and Ammonia Insulation
Cold Water Pipe Insulation
Vitribestos Stack and Breeching Lining
Steam Traps

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Madison Ave. at 41st St.
New York City
10 Factories—Branches in 64 Large Cities

For Canada
Canadian Johns-Manville Co., Ltd.,
Toronto

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

Through—

Asbestos

and its allied products

INSULATION
that keeps the heat where it belongs
CEMENTS
that make boiler walls leak-proof
ROOFINGS
that cut down fire risks
PACKINGS
that save power waste
LININGS
that make brakes safe
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE
Serves in Conservation

SEVENTY-SIXTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXIII. NUMBER 8] NEW YORK, AUGUST 21, 1920 [15 CENTS A COPY 20 CENTS IN CANADA

Emptying Eight Freight Cars into a Thimble

PICTURESQUE Long Park Plateau, in the Paradox Valley, Colorado, is the location of the group of radium luminous material claims which are steadily producing tons of radium-bearing carnotite. The nearest railroad is 58 miles distant, a trip of three and a half days for the six-horse wagons over rugged country, too rough for even light motor trucks.

Starting east with 250 tons of carnotite, a few weeks' production at the Long Park mines, filling 8 freight cars, the ore travels 2,600 miles through Denver, Chicago and New York, until the cars are finally unloaded at the main radium luminous material plants in Orange, New Jersey.

Scientific knowledge and infinite patience reduce that tremendous bulk of 250 tons of ore to scarcely a *thimbleful* of radium, Three distinct plants and hundreds of processes make possible the final desired reduction—*one gram* of radium element.

It seems inconceivable that a gram, which is approximately *1/28* of an ounce, can be worth $120,000. Yet this is true of radium and when one realizes that that tiny amount of radium combined with 20,000 grams of the secret process phosphorescent zinc sulfide results in sufficient radium luminous material to self-light for life *667,000* watches or clocks, the true value of radium to modern society is apparent.

In other words, one gram of radium plus 20,000 grams of zinc sulfide equals enough radium luminous material to self-light the time piece of every male adult in the City of New York.

All of which is interesting in view of the fact that the State of New York has recently purchased two and a quarter grams of radium, the largest commercial transaction of its kind ever made and the first purchase of radium by any State for a purpose of social utility. The 1920 State Legislature voted an appropriation of $225,000 for the purchase of the radium. The reason why this rather imposing sum does not go very far in the purchase of radium is as stated above; but perhaps it will be a little more clear if we consider the direct visual appeal of the drawings herewith.

The radium is to be used for research work in behalf of the New York State Institute for Malignant Disease, under the direction of Dr. H. R. Gaylord and his staff in Buffalo. The first shipment of one gram—about one-thirtieth part of an ounce, was delivered to a representative of the Institute in a lead cylinder eight inches in diameter and a foot long. The Bureau of Standards tested the radium and certified as to its weight and purity.

These graphic comparisons tell why a gram of radium sells for $120,000

No Relation Between Cultivation and Rainfall

CAREFUL scientific records kept by the National Weather Bureau for more than a half century show irrefutably that the time-honored theory that the cultivation of semi-arid land increases the amount of rainfall in that region is wholly incorrect. During the period under discussion a decided increase in the area of cultivated land is noteworthy in the Great Plains States and yet there has been no definite and permanent increase in the precipitation records of that section of the country. The rainfall reports of Uncle Sam's scientists show that during the period from 1868 to 1892 inclusive the average precipitation for the Great Plains States was 19.25 inches while for the period from 1893 to 1919 the average rainfall was only 18.58 inches despite that the acreage of tilled crops increased very appreciably during the latter interval.

Furthermore it has been conclusively demonstrated the wet years and dry years do not occur—as popularly believed—in periods of two to three years each. There is no regular or routine occurrence of these times of drought or abundant precipitation. Sometimes the dry years come during wet periods or vice versa. It is not possible to predict potential precipitation from past records. A wet year may be followed by a very wet one or a dry year may succeed another dry one as the case may be. However, years of abundant and well distributed rainfall encourage a western extension of the cultivated area, and when a succession of favorable seasons occurs the farming operations are pushed much farther west into regions which ordinarily do not provide anywhere near enough moisture for profitable crop production. The following season may be a dry one and the boundary line for cropping activities may again be carried far eastward of its previous location. The rainfall of the Great Plains section varies considerably from one season to another but its vagaries are, in no respect, due to the increase or diminution in the area of tilled crops planted and harvested.

Protection of Steel from Rusting by Painting

SOME useful notes on the protection of steel structural work from rust by means of painting are given by J. H. Shean in the *Canadian Engineer*. According to the author, the first coat of paint laid on the well-cleaned steel-work is of great importance from the point of view of rust prevention. The most generally accepted "inhibitive" pigment is red lead. It is now possible to buy red lead containing only 2 per cent of litharge (which in excess causes the troubles associated with this pigment) and 98 per cent true lead, PbO. This makes an ideal paint for a first coat. Being extremely fine it fills all pores and brushes out in a smooth, even film, free from voids. It stays in place on vertical surfaces, and does not act ropy under the brush. The vehicle with which the lead is mixed is fully as important as the pigment itself. The merit of linseed oil is well known, although the paint film is much better if reinforced with Japan oil. Japan oil, besides reinforcing the oil film against shrinkage, furnishes sufficient driers of the right kind. The amount of red lead to be used in one gallon of vehicle is a question on which engineers differ, the general average for railroad use being about 25 pounds to the gallon.

The usual dark aftercoats are probably all good if applied rightly, but the fact remains that they are all heat attractors. Unless the price of material is the main consideration, there is no reason why steelwork should not be painted in light colors and their resistance to heat rays would certainly be easier on the oil film which holds the pigment together than the dark colors which attract and hold the heat rays. The light colors will last sufficiently longer than dark colors to pay any extra expense. It may be argued that light colors become unsightly in a short time from dirt and smoke. This cannot be noticed to any extent except overhead on through truss bridges and overhead bridges on which even if painted black smoke marks show.

It would appear from this rather detailed discussion of the scientific aspects of what has usually been looked upon as a commonplace to be settled by the rule of thumb or the buyer's whim, that it will indeed be a paying proposition to subject the painter's materials and technique to thorough scrutiny.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Modernizing the North River Waterfront

THE agitation in favor of a thorough reconstruction of the facilities of the Port of New York has shown its first fruits in the plans of the Department of Docks for a complete rebuilding of thirty-two piers extending north from Vesey Street on the Manhattan waterfront of the Hudson River. Credit for this extensive work is due to Dock Commissioner Murray Hulbert, who is now abroad for the purpose of studying the up-to-date facilities of the leading ports of Great Britain and the Continent. Briefly stated, the plan contemplates the removal of thirty-two of the present narrow piers, with their inadequate slips and the construction, in their place, of eighteen modern piers, with wide slips between them, capable of accommodating the largest vessels.

Every one who is familiar with conditions at this port has known that our pier system was antiquated; and that portion of the recent report of the Dock Commissioner which deals with the history of this stretch of the Hudson River pier system reveals how antiquated it is, and gives some very interesting data as to its inception and subsequent development.

We are told that up to the year 1830 the shore along the North River consisted of a series of beaches, with occasional landing platforms built out over them. The commerce of the city was carried in sailing vessels, which were moored in deep water, the freight being transferred between ship and landing stage by small boats. Then the citizens who owned waterfront grants where the water was sufficiently deep, began bulkheading their properties so that vessels could lie alongside and discharge and load direct to shore; and it was this work that marked the beginnings of what is now known as West Street. The next development came in 1857, when the Board of Aldermen began to bulkhead the shore and build piers; and thereafter no private owner was permitted to build piers without permission of the city authorities.

Shortly after the Civil War, the need for a comprehensive plan was felt, and in 1870 the first Board of Docks was created, and Gen. George B. McClellan, as its chief engineer, drew up the plan of 1871, which provided, between Vesey and Perry Streets, a continuous bulkhead line, with a pierhead line 600 feet out in the river. Piers not over 600 feet in length were located at definite locations. The traffic requirements of that day and the future were believed to be amply met by making these piers from 40 to 60 feet wide, with slips between them of from 100 to 150 feet. Many of those piers are in existence today.

Now McClellan was a capable engineer and we may be sure that both he and the civic bodies in consultation with which he worked believed that in this, the first comprehensive layout of the Manhattan waterfront, they were making ample provision for future developments, both as to the size of ships and the magnitude of the traffic to be handled.

It would be unjust to the city fathers of that day to say that they were lacking in vision; rather, the present congestion is to be blamed upon the city administrations of a later day for failing twenty-five years ago to at least commence the reconstruction which is now to be undertaken after a lapse of fifty years.

The moral of the whole thing is obvious. When Commissioner Hulbert returns he should subject even the present plan to mature consideration, based upon the data he has gathered in Europe where piers of from 300 to 500 feet width are common. Furthermore, any plan for improving the North River waterfront should be worked out with a view to its coöperation with the double-deck elevated railway, which will ultimately be built from the North River Bridge at Fifty-ninth Street to the Battery.

We are gratified to note that the plans for the new piers provide for a 30-foot apron at the side of the piers for railway tracks which will be spanned by gantry cranes. This is in line with the latest practice, and it will add immensely to the rapidity of turn-around of the ships that lie at these piers.

Double-Decking a Cure for Street Congestion

PROBABLY there was never a time in the history of this city when the matter of congestion of our city streets and the remedies therefor received so much attention as it does today. The files of the SCIENTIFIC AMERICAN show that many decades ago plans were being suggested for getting rid of the congestion which even then was felt to be intolerable. But conditions that were intolerable then would today be welcomed as a positive relief in some of our more crowded centers on Fifth Avenue and downtown.

Of all the suggested plans for relief, none would be so immediately effective as the double-decking of a few of our most congested arteries of travel. We have always strongly advocated this plan, in favor of which everything can be said and against which there is no serious objection. The double-decking of a street would immediately double and more than double its capacity, since it would not only double the number of foot passengers and vehicles that could comfortably make use of it, but, because of the greater fluidity of this traffic there would be a resulting increase in the number of people and vehicles that could pass a given point in any period of time on each level.

The city of Chicago is satisfied that double-decking is practical, and it is going to carry out a work of this character in what is known as the South Water Street improvement, which will extend for several blocks, or about 3,500 feet, along South Water Street. Several purposes are to be served, the first of which is to secure a new east and west thoroughfare on the margin of the well known "loop," the central business district of Chicago, which will serve as a by-path for heavy traffic which now crosses the route. Also, it will avoid interference of east and west trucking traffic with normal north and south traffic over the river bridges. Fronting on the river it will naturally provide freight handling facilities; and also, in addition to separating the fast and slow traffic and increasing traffic capacity, there are certain auxiliary advantages secured in the way of providing parking accommodations for automobiles, and the facilitating of the delivery of freight to adjacent buildings on two levels.

All heavy motor trucks, trolley and horse-drawn vehicles would be confined to the lower level, the upper deck being reserved for light motor trucks and automobiles. The absence of tracks would make it possible to utilize the center of the upper roadway for the parking of automobiles—an arrangement which would greatly increase the number of people who use their machines to reach their business offices. The upper deck would extend down the crosstown streets at the more congested centers; elsewhere, access would be had by means of inclines. These would be less than half the width of the side streets; the ramps for downtown traffic leading west and those for uptown traffic to the east.

Now all of these advantages, with the exception of those pertaining to river frontage, would be secured if the same method of double-decking were applied at some of our most congested centers, say on Broadway, Fifth Avenue and certain of the crosstown streets. By judicious coöperation of the engineer and the architect, the upper deck could be so laid out as to avoid the unsightly constructions which form our elevated railroads. An obvious suggestion looking to this end would be to build the supporting columns and floor beams in a series of flat arches and encase the whole in white glazed terra cotta. For lighting the lower deck or street level, it would be sufficient to reserve the upper deck for light automobile traffic and fill in the floor from curb to curb with a heavy design of skylight construction, similar to that now used on passenger sidewalks. Heavy trucking would be relegated to the lower deck at street level. An incidental advantage of this system would be that the store frontage along the street would at once be doubled, since property owners would readily appreciate the advantage of having additional window display on the second floor. Another and very practical advantage would be that the lower deck would afford a completely sheltered thoroughfare in rainy weather and during the snows and frosts in the winter time.

Our Share of the Surrendered German Ships

IT was difficult to realize that the five rusty and unkempt ships, the battleship "Ostfriesland," the fast cruiser "Frankfurt," and three destroyers, as they made their way slowly into New York harbor, were once among the finest representatives of their respective types in the German navy. In their war-and-weather-worn condition could be read the tragic history of the German navy since the battle of Jutland; for to the scars of that battle have been added the neglect of several years of inactivity in German ports, and the marks of long submersion beneath the waters and in the mud of Scapa Flow.

The question has been frequently asked as to what disposition will now be made of these ships. So far as the inclusion of any of them in our Navy is concerned, it may be stated at once that, though they came into harbor flying our flag, none of them will ever go into active commission—this for the reason that the terms of their award to the United States by the Allied Naval Commission, after they had been surrendered under the Versailles Treaty, provide that they must be destroyed within one year.

The tentative plans of the Navy Department contemplate the exhibition of the battleship "Ostfriesland" in a few of the leading ports of the country, after which, in accordance with our engagement, the five vessels will be destroyed. Previous to that, however, a thorough study of their hull construction and armor plan and of their engines will be made by representatives of the Bureaus of Construction, Engineering and Ordnance. After that the "Ostfriesland," at least, will be allocated to a service in which she will prove to be of the greatest value to the Navy. She will be used for target practice and gradually shot to pieces for the sake of the invaluable lessons which can thus be learned. It will be remembered that one of our early battleships, the "Texas," renamed the "San Marcos," was used for the same purpose.

What renders the "Ostfriesland" of such great value as a target is the fact that the Germans paid particular attention to the protective elements in their battleships, and that they probably put a larger percentage of the displacement of their ships into deck and side armor than any other contemporary navy. Their armed vessels received a terrific hammering from the 13.5- and 15-inch guns of the British, and it was their very excellent armor protection, and particularly the protection afforded to the vitals by well-disposed deck armor, which kept the high-explosive shells out of the magazines and enabled the badly punished fleet to get back to port.

Not only will the "Ostfriesland" give us an excellent opportunity to determine just how much and what kind of damage the various types of shell can do on a comparatively modern battleship, but she can be used for practice at those extreme ranges of 18,000 to 20,000 yards and over at which future engagements will probably be fought.

As to the fast cruiser "Frankfurt" and the three destroyers, it is certain that even if the terms under which we received these ships did not call for their destruction within a year, they are in such poor condition as the result of neglect and submersion at Scapa Flow that it would never pay to repair them for use in our own Navy. Even if they could be refitted and placed in commission, they are so different in speed, accommodation, character of armament and general maneuverability that it would be difficult, if not impossible, to fit them conveniently into our fleets.

Naval and Military

National Guardsmen to Enter West Point.—The attention of the Governors of the several states has been called by the War Department to the fact that enlisted men of the National Guard who on July 1st, 1921, shall be from nineteen to twenty-two years of age and shall have served one year in the National Guard will be eligible for selection as applicants for admission to the National Military Academy.

The Fastest American Destroyers.—All American records for speed were broken by the torpedo boat destroyer "Satterlee" during her standardization firing over the measured mile off Rockland, Maine, when she made a mile at the rate of 38.26 knots. The best previous record of 37.04 knots was held by the American destroyers "Dent" and Wickes." The boat also established a new record in her class for horsepower, developing a maximum of 31,223. The "Satterlee," which has been in commission six months, was built by the Newport News Shipbuilding and Dry Dock Company.

The Fifteen-Inch Guns on the "Hood."—At first sight it may seem strange that the "Hood" should carry only the same armament as the "Queen Elizabeth," built some eight years before the "Hood." As a matter of fact, the "Queen Elizabeth's" guns are forty-two calibers in length; but the guns of the "Hood" are forty-five calibers long and have greatly increased muzzle velocity. It is believed that the gun weighs a little under one hundred tons and fires a 1,950-pound shell with a muzzle velocity of 2,800 foot-seconds. Another improvement over the "Queen Elizabeth" is that the new guns have an elevation of thirty degrees for a maximum range of 38,000 yards. The loading gear has been so improved that the "Hood" is credited with being able to fire a salvo of eight guns every thirty-five seconds.

The Aircraft-Carrier "Eagle."—When the British decided to build a fleet of aircraft carriers they changed the design of one of the battleships so as to provide landing and starting platforms and interior accommodations for aircraft. This ship has recently been completed, and she forms the third large aircraft carrier, the others being the well known "Argus" and "Furious." Many British officers consider that the "Eagle" is altogether too slow to make an efficient aircraft carrier. She was originally constructed as a dreadnought battleship for Chili. Her designed speed was 22.75 knots, and it is possible that her lightening up due to the removal of heavy guns, ammunition, et cetera, may have enabled the speed to be raised to 25 knots. An aircraft carrier, however, should have at least 30 knots speed.

Japanese Strength in Super-Dreadnoughts.—We are not among those who believe that the growth of the Japanese fleet represents any threat to our naval supremacy in the Pacific. When the super-dreadnoughts that Japan has built or now has on the ways, or has proposed for construction, have been completed, she will have in dreadnoughts of the first class only a little over one-half the super-dreadnought strength of the American fleet when the three-year program of 1916 has been built. At present she has four of this class and has under construction four others, so that when all are completed she will have a total super-dreadnought tonnage of 251,000. Even if our super-dreadnought fleet is equally divided between the Atlantic and the Pacific, we would still have a great excess in strength in the Pacific over this Japanese fleet.

Warship Tonnage of the World.—In a statement made by Rear Admiral Albert P. Niblack, Director of Naval Intelligence, before a Committee of Naval Affairs, the warship tonnage of the principal naval powers on July 1st, 1919, was as follows: The vessels completed in total tons were, for Great Britain, 2,652,130; the United States, 1,160,355 tons; France, 623,850 tons; Japan, 580,716 tons, and Italy, 454,293 tons. The total tonnage of ships building was for Great Britain, 246,650 tons; for the United States, 995,313 tons; for France, 247,050 tons; for Japan, 267,250 tons, and for Italy, 147,250 tons. These figures for ships built must be reduced for Great Britain by several hundred thousand tons, for the 150 vessels, including pre-dreadnoughts which have been stricken from the list. Similar deductions on a smaller scale should be made for the other powers.

Astronomy

More Newspaper Astronomy.—An English newspaper, quoted in *Popular Astronomy*, undertakes to answer the question "Why Is the Moon Not Always Round?" and enlightens its readers in the following terms: "It is. The reason it changes in appearance is that the earth's shadow is thrown upon it by the sun, and the size of the shadow varies each night when the moon is visible."

Sunspots Visible to the Naked Eye.—The frequency of sunspots large enough to be visible to the naked eye is greater than is generally supposed. At a recent meeting of the British Astronomical Association it was stated that members of the Solar Section of the society had observed the sun with the naked eye on 302 days during 1919, and on 126 of these days spots had been seen with the naked eye.

Spectroscopic Parallaxes.—Messrs. Adams, Joy and Strömberg report that the rapid accumulation of parallaxes determined with a high degree of accuracy by the trigonometric method has made it possible to complete a revision of the standards of reduction used in the new spectroscopic methods of determining parallaxes, and to derive values that may be considered as subject to but little modification in the future. In their comparison of the results of the two methods they have used trignometric parallaxes for 657 stars. Omitting a few stars that present special difficulties in the application of the spectroscopic method, the average difference between values found by the two processes is only .001 second of arc—a difference comparing favorably with that found between the results obtained by different observers using the trigonometric method alone.

Occultation of a Star by Saturn.—The occultation of the star Leipzig I., 4091, by Saturn on March 14, 1920, was observed under favorable conditions at Mr. Reid's observatory, Rondebosch, near Cape Town. From the report of the observations published by Mr. Reid, it appears that certain phenomena were of striking interest; viz. (1) there was very little diminution of light when the star was behind the ring, and (2) the light of the star died out gradually before immersion, and on its reappearance the star seemed to be within the disk of Saturn. From the first of these facts, says the *Journal* of the British Astronomical Association, seeing that the ring is now turned to us almost edgeways, it would seem that the particles of which the ring is composed are either very much smaller or farther apart than they have heretofore been supposed to be. From the second observation the inference may be drawn that Saturn is a smaller globe than has been assumed, and that it is surrounded by an atmosphere of considerable extent.

Color Changes on Jupiter.—Writing in the *Monthly Notices* R.A.S., Mr. A. Stanley Williams deals at length with a recurrent change in the color of Jupiter's equatorial zone. This zone is normally nearly pure white. Toward the end of 1869, Mr. John Browning called attention to a remarkable change to a deep tawny yellow, and several attempts were made about that time to trace the history and possible periodicity of similar changes previously observed. With the observations since accumulated at his disposal, Mr. Williams finds that during the past 150 years there have been at least five occasions when the tawny color made its appearance in a very definite manner, viz., 1789, 1839, 1860, 1871 and 1898. Its visibility generally lasts about three years. It has recently reappeared, and was described last April as very conspicuous. Apart from this broad orange-colored band the planet is, at present, remarkably free from color. Taking into account certain less definite appearances, Mr. Williams finds a period of 11.95 years. This is so near the planet's period of revolution around the sun that the true period is probably identical with it. The tawny color makes its appearance a little before the planet reaches perihelion. The writer has found nearly the same period for changes in the color of the two dark equatorial belts. A connection with the sunspot period naturally suggests itself. This is generally supposed to be about 11.1 years, but it is noteworthy that Professor Turner, by harmonic analysis, has derived a period of 12.0 years for the interval 1860-1894 and also for the interval 1889-1919.

Aeronautics

Holland to Java Flight.—The Dutch Government contemplates offering a prize for the first Dutch aviator who flies from Holland to Java. Three competitors have already offered themselves. Lieutenants Backer and Wullften Palthe, who will make the journey in a Vickers F-3, fitted with two Rolls-Royce engines, will fly from Amsterdam via Brest, Marseilles, the Piraeus, Basra, Karachi to Culcatta, and thence via Rangoon, Penang and Singapore to Batavia, in Java.

Gordon-Bennett Cup Race.—The French Aero Club will make the contest for the Gordon-Bennett Aviation Cup an occasion of considerable importance, according to all reports from France. The race is to be the principal event of an "Aviation Week," in which aviators from numerous countries will compete for prizes. Rumor has it that the United States has several surprises in store for the Gordon-Bennett race, among these a new engine of tremendous power for its weight. It would not surprise us if the American aircraft manufacturers were well represented; indeed, an American may even win the great contest if all we have heard about the new engine is true.

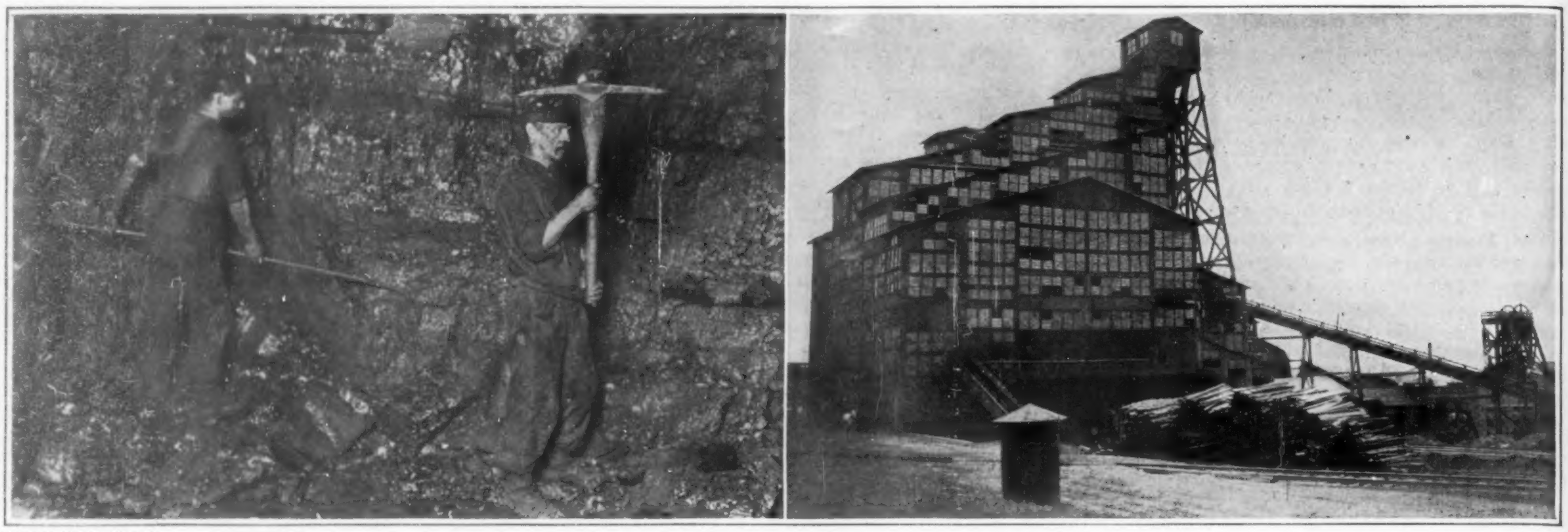
Oxygen Heater for High Fliers.—The Army is conducting tests on a new apparatus for heating oxygen at high altitudes, in order to prevent a recurrence of failure such as experienced by Major Rudolph Schroeder recently in his record climb. The apparatus consists of a refined thermostatic interrupter in connection with electric resistance coils, attached to the oxygen generator. The apparatus heats the oxygen as it leaves the exhaust valve of the container, and keeps it heated until it reaches the distributer. This prevents any moisture present from freezing in the delicate distributer, and it also heats the oxygen again before it enters the pilot's mask.

Our Dirigible R-38.—We understand that the American crew to be trained in England to fly back our monster airship, the R-38, has been selected. We hear also from England that the ship will be ready to commence her exhaustive trials fairly soon. It takes a long while to tune up an airship—there are so many balances to be perfected, apart altogether from engine trials and the like. The following figures which have not been published in this country before will give a fair idea of the dimensions of the R-38, in comparison with the R-34, which flew the double Atlantic journey last summer.

	R-34	R-38
Length (in feet)	639-5	695
Capacity (in cubic feet)	2,000,000	2,700,000
Tonnage	60-7	92-0
Maximum Speed	58	70

The German airship "Bodensee," to which so much publicity has been given, is more than one hundred feet shorter than the R-38, has a gas capacity of only 700,000, and is of 21-3 tonnage. It is claimed, however that her maximum speed is 80. Her main disadvantage is obviously her inability to travel great distances on account of her limited gasbag capacity.

High Speed and High Altitude.—Major Schroeder after his recent height record flight, made an interesting statement that he believed that at great heights—heights beyond those he has reached—it would be possible to make use of air currents and to fly at enormous speeds. Some French inventors now claim that in a few years it will be possible to fly at a height of 40,000 feet and maintain a speed of nearly 300 miles an hour. Mr. Kipling many years ago prophesied that in an aircraft all metal and of cigar shape we should hurtle through space at heights of rarefied atmosphere where there was practically no air resistance. What exactly the propellers would have to bite upon he did not disclose. But the French inventors have produced a mechanism which compresses the air in which the propeller rotates to normal atmosphere. The economic value of this invention is obvious, for the higher one goes the more quickly one travels and the quicker the journey is accomplished the less fuel will be used. On the other hand, if there be these furious air currents at very great heights as Major Schroeder hints, there will be insurmountable air resistance in some directions. By the way, someone recently referred to the gallant Major as the man who had fallen farther than anyone except Adam!



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Left: **In the coal mine, with the miner and laborer. The ever-increasing wages of the coal hands is reflected in large degree in the high price of coal.** *Right:* **The coal breaker, where the coal is broken and the slate removed, making the coal ready for market**

Is There a Coal Shortage?

A Survey of the Coal Question in Our Largest Coal-Consuming Center

By Harry A. Mount

WE cannot get along without coal. Even in this enlightened age of hydro-electric developments, oil-fired boilers, gasoline engines, alcohol-burning devices and so on, coal remains the prime fuel of business and home alike. The recent rumors of an impending coal famine this coming winter have naturally caused great consternation far and wide. A coal famine would affect our industries, public utilities, railroads, steamship lines, homes, personal health—in a word, our entire national life. Truly, this is a grave question of the moment. We assigned the task of investigating the coal situation to Mr. Mount, and in the accompanying article he reports his findings. It appears as though there will be no coal famine, barring unforeseen events.—THE EDITOR.

TAKE your watch from your pocket between five and six o'clock in the evening and count off sixty seconds. During that brief time seventeen tons of coal—nearly enough to fill one of the largest coal cars—has been shoveled under the boilers that furnish power to run New York City's network of subway; elevated and surface car lines, furnish electric power for lights, and supply gas for cooking. More coal is burned at that hour than at any other; but in a single day 15,000 tons are required for these three public utilities—transportation, electric current, and gas.

If all this coal were loaded on a single train it would stretch out more than five miles. This coal must arrive day in and day out, month after month with unfailing regularity. Much depends on it. If these utilities were left for a day without coal the great city would be utterly paralyzed and the effects would be felt in every corner of the land.

If the gas supply fails in a smaller community, one can rig up an oil or coal stove, or even find wood enough to cook the family meals; but imagine the result if each of the hundred or more families in a big apartment house each suddenly had to find coal or wood and proper stoves to burn it. Utter confusion would result if the whole city were suddenly cut off from its gas supply. And New York is not supplied with natural gas but with artificial gas, made from coal.

If a city the size of Cleveland or St. Louis finds its street car service suddenly shut off, the citizens usually can press busses or automobiles into service, or walk, and the city's business goes on. But even if enough busses could be found to carry New York's great throngs of workers, there would not be enough room on the streets for them. Transportation lines overhead and underground are absolutely necessary, for the streets are overcrowded with normal traffic.

If electric power is a great convenience in smaller cities, it is an absolute necessity in New York. Without it elevators would stop, many of the smaller industries would halt for lack of power, practically every light in the metropolis would be extinguished and almost countless other activities would cease. The tallest buildings would be without fire protection because steam fire engines cannot throw a stream of water to their tops and powerful electric motors are depended upon.

In short, should the coal supply of New York's public utilities cease the city would be completely paralyzed. Should the tie-up last for any considerable period the city's great freight terminals would become glutted with freight, which could not be loaded on boats. Since New York is the "neck of the bottle" for most of the country's export trade as well as a considerable part of the raw material which keeps our own factories in New England and coast points running, the effects of such a tie-up would soon be felt outside the city. Railroads which keep a steady stream of freight moving into New York would have to cease shipments and the freight congestion would soon extend far inland. Drastic measures would have to be taken to keep New England factories running and the extra freight cars needed in this effort would draw from the already meager supply and slow-up freight movement throughout the entire country. A long shut-down of New York's public utilities would start a cycle of calamitous events from which every man, woman and child in the country would suffer.

And then consider the strength of the thread upon which this continued service hangs. Because of the enormous quantities of coal used, and the lack of storage space on crowded Manhattan Island, no great reserve supply of coal can be kept on hand. Some of these utilities have no more than two weeks' supply even in normal times. Many of them have less at present. A steady stream of coal must pour into their bins from the mines or disaster is imminent.

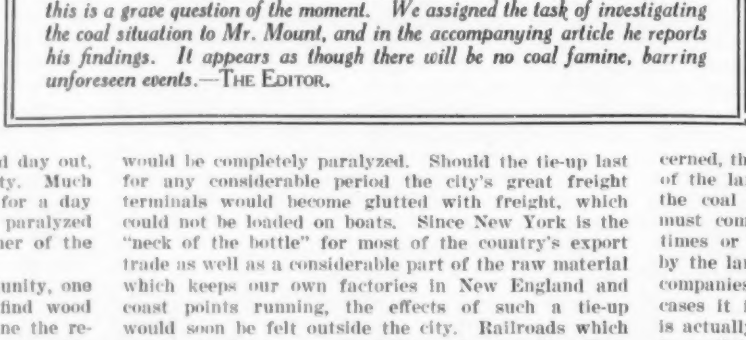
We have heard much recently of an impending coal shortage. But so far as the public utilities of New York are concerned, there is no coal shortage at present. Executives of the largest companies agree that they can buy all the coal they need. Because their supply of coal must come in a steady stream, rain or shine, good times or bad, they are regarded as "A1" customers by the larger coal mines. As a rule the public utility companies buy independently at the mines. In some cases it is necessary to contract for more coal than is actually used, but on the whole an adequate supply is available.

Investigation shows that in the case of one or two small public service corporations which have complained bitterly of a "coal shortage," the real trouble is that they are unwilling to pay the present market price for coal and are living a "hand to mouth" existence in the hope that coal prices will drop.

It is true, however, that almost all of the large companies have not on hand a normal coal reserve. This is the result of cumulative causes rather than any sudden emergency. During the coal strike of last winter the reserves were depleted. The strike delayed shipments to the Northwest until the Great Lakes were frozen over and then shipments which would have been made by boat had to be made by rail. As a result many coal cars instead of making a four-day trip to Cleveland or Toledo, made four-week trips to Duluth. This drew heavily on the already inadequate supply of coal cars, adding to the uncertainty of deliveries to New York.

Then followed the influenza epidemic which had the effect of making deliveries still lower and more erratic. And finally, when traffic was getting back to normal, there came the "outlaw" rail strikes and the transportation system of the East was again tied in knots, many of which have still to be untied.

(Continued on page 189)



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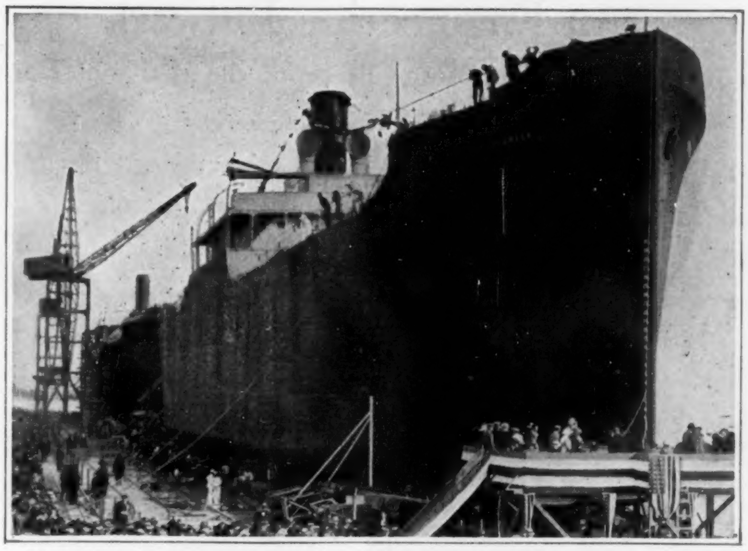
Much has been said about the use of coal cars for transporting building materials. Here is undeniable evidence that such has been the case. This practice is in direct violation of the Interstate Commerce Commission's ruling

A Concrete Oil Tanker

THE launching of the 7,500-ton concrete oil tanker "Cuyamaca" recently took place at San Diego, Cal. The ship, which is shown in the accompanying illustration, is 434 feet long and as trim as any steel freighter. Just behind the "Cuyamaca" is a sister ship soon to be launched. The two tankers were built for the United States Shipping Board and have been chartered by the France and Canada Steamship Company. These two ships formed part of the Shipping Board's program for the construction of a fleet of concrete freighters. It has been announced that it is not the intention of the Board, at least for the present, to build any more of this type.



Launching of the concrete 7,500-ton, 434-foot, oil tanker "Cuyamaca" at San Diego, Calif. This and a sister ship, shown astern in the picture, were built for the U. S.Shipping Board

The Contest for the Harmsworth Motor Boat Trophy

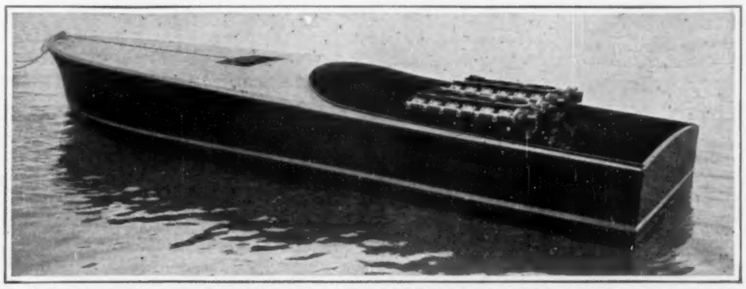
IN preparing for the 1920 contest for the famous Harmsworth trophy for motor boats—one of the most coveted of international trophies, American builders, profiting by past experience, constructed three boats of exceptionally high power in proportion to their size and weight, which were designed to meet the variable conditions at the course, which is laid off the Isle of Wight. We present illustrations of these three boats—"Miss America," "Miss Detroit V" and "Whip-po-Will, Junior."

It is needless to say that all three are of the hydroplane type, and each of them developed on trial speeds which made the prospects of our capturing the cup look very favorable. "Whip-po-Will," owned by Albert L. Judson, of New York, was the most powerful of the three American crafts, being driven by two Bugatti engines in tandem, whose combined horse-power is about 900. Unfortunately, during the preliminary tuning up of this boat on the day before the races, she caught fire and sank. The other two boats were designed and built by G. A. Wood, of Detroit, who more than any other man in this country has contributed to the development of hydroplanes of extremely high speed. Both boats have the same motive power, consisting of two reconstructed Liberty engines, driving separate propellers, the combined horse-power being about 800. The faster boat of the two, "Miss America," is a craft of extremely small dimensions, considering her great horse-power. She is twenty-six feet in length by seven feet in beam. Experience on the other side has shown that a boat of such dimensions and speed is at a serious disadvantage in the choppy seas which are liable to be experienced on the Isle of Wight course, and accordingly Mr. Wood built another boat of the same horse-power and driven by the same type of engine as "Miss America," but considerably larger and more seaworthy. This boat which he named "Miss Detroit V" is 38 feet long and 8 feet in beam. It was known that some of the foreign competitors would probably build up to the limit of length at forty feet, and Mr. Wood figured that, with his two boats in the race, he would be prepared to meet whatever weather conditions might be found on the day of the race.

The course of thirty miles was covered in five rounds of six miles each. As competitors the two American boats had "Maple Leaf V" and "Maple Leaf VI," owned by Sir Mackay Edgar, and "Sunbeam Desenjol," which belonged to Mr. Coat Allen. In the first race "Miss America" came in first, having covered the thirty miles at an average speed of 51.45 knots, her fastest lap being covered at the rate of 56.63 knots. "Miss America" covered the course in 38 minutes 17 2/5 seconds; "Maple Leaf VI," second, in 41 minutes 30 seconds; the third boat, "Sunbeam Desenjol," took 43 minutes 30 seconds; and "Miss Detroit V," the fourth in line, required 46 minutes 12 3/4 seconds for the thirty miles. The comparatively slow time of "Miss Detroit V" is due to the fact that she developed engine trouble in the fourth round, and after that she was unable again to maintain her maximum speed. "Maple Leaf V" also had engine trouble and had to retire from the race, which put "Miss Detroit" in the fourth place.

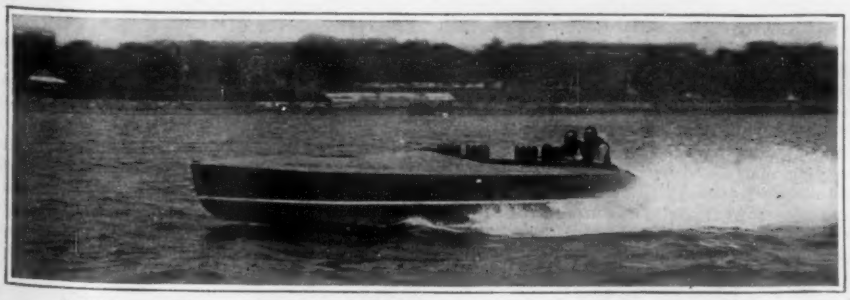
The second day's race was also won by "Miss America," with "Miss Detroit V" in second place, "Maple Leaf V" third, and "Maple Leaf VI" fourth. The time of "Miss America" for the thirty miles was 37 minutes 5 1/3 seconds, and her average speed was 53.42 knots. Her highest speed, made during the first lap, was 56.41. "Miss Detroit V" took 37 minutes 43 4/5 seconds to cover the course, and "Maple Leaf V" took 37 minutes 59 seconds. "Maple Leaf VI" was fourth and "Sunbeam Desenjol" fifth.

The Harmsworth Cup comes once more to America, and as Sir Mackay Edgar, owner of "Maple Leaf V" expresses his purpose to build a faster boat and try again, we may see another race for the Cup next year, probably on the Detroit River.

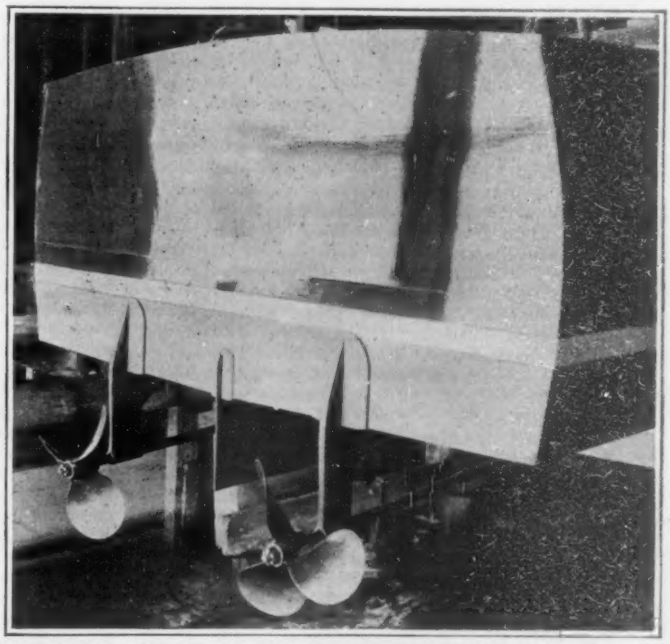


"Miss America," built and owned by G. A. Wood of Detroit, Mich. Winner of the Harmsworth Cup. This little craft, 26 feet length by 7 feet beam, is driven by two 400-H.P. Liberty motors

"Miss Detroit V," built by G. A. Wood. Length 38 feet; beam 8 feet. Driven by two 12-cylinder, 400-H.P. Liberty motors



"Whip-po-Will Jr.", owned by A. L. Judson, N. Y., is driven by two 16-cylinder, American-built Bugatti motors, in tandem. Horse-power 900



The stern view of "Miss Detroit V," showing method of supporting the twin, 3-bladed propellers, on each of which 400 horse-power is developed

Oil, Sugar and Alcohol from an African Tree

THE sump tree or *Balanites aegyptiae* Del., five or six million tons of whose fruit are gathered annually in Senegal, is a variable source of oil, sugar, and alcohol. The fruit consists of an oleaginous spindle-shaped kernel enclosed in a hard fibrous shell and surrounded by sweet pulp containing a very high percentage of sugar and enclosed in a tough skin. The kernel contains 41.80 per cent of fats and 25.32 per cent of nitrogenous substances. However, the shell is so difficult to crack that only the pulp can be at present considered useful for industrial exploitation. This pulp contains sufficient fermentable material to hold from 9.7 to 10.8 cm. of sugar per 100 gr. of fruit. The composition of the fruit is as follows: sweet pulp, 42.9 per cent; shell, 48.3 per cent; oil bearing kernel, 8.8 per cent. The sweet pulp contains 40.3 per cent sugar.

An Engineering Bulwark

The Proposed Standing Army, for Purposes of Peace, of the Men Who Know How to Do Things

By Richard L. Humphrey

CONSTANT repetition weakens as well as strengthens, and it is an old, old story what the engineers did in the great war. Perhaps it is not generally realized, however, that much of this achievement was due wholly to the manner in which the engineering resources of the country were mobilized under a single direction. The question now is in order, to what extent are we to see this temporary organization abandoned and to what extent are we to insist that if a thing is good in the war emergency it is good in the routine of peace? Some of the responsible heads of the engineering profession are trying to answer this question on the side of efficiency, and to preserve as a permanent asset the marvelous organization which enabled the American engineer to function so far beyond the fondest expectations during the war. That in a word is the story of the Federated American Engineering Societies, of which Mr. Humphrey, Chairman of the Joint Conference Committee, tells us here.—THE EDITOR.

THE average citizen in this country has little knowledge of the work of the engineer. To him the word "engineer" means the man who runs a locomotive or some other steam engine, or in some cases he recalls that his plumber has under his name "Sanitary Engineer." He does not associate with the engineer the great transportation systems of the country, the street railway service, the telephone and telegraph, the office buildings, the water supply, the sanitary disposal of sewage, the lighting systems, the street pavements and highways, proper housing and town planning, to say nothing of the bridges and other structures that safely carry millions of people, all of which are daily necessities. Nor does he realize or appreciate the fact that the marvelous development of this country and of its resources has been an engineering achievement in which the engineer has been a pioneer.

During the war the engineer came into a prominence hitherto unknown by reason of the fact that he was essential to the winning of the war and it early became apparent that the engineer was doing yoeman service. It is no disparagement of the bravery of the flower of the American people who fought in France and Flanders to say that their work would have been of little value had they not been supplied at the critical moment with the vital munitions of war. The brilliant work of the engineer in providing Europe with harbor, transportation, housing, commissary and telephone facilities is a matter of common knowledge; and this is also true (though to a lesser extent because more removed from the theater of war) of the tremendous work done in producing ammunition, guns, airplanes, locomotives and cars for the transportation of these munitions of war in this country as well as in Europe; and particularly is this true of the ships which were so vital a factor in the feeding of the American Expeditionary Forces. The spectacular building of ships has been one of the wonders of the world. During this time it became evident to the public that the engineer was a prime factor in this achievement.

The war, therefore, created in the mind of the public a greater appreciation of the services of the engineer and created in the engineer a greater desire for service. The needs of the Government for engineering assistance during this crisis led to the creation by the four great National Societies, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, of an Engineering Council to provide a medium "for the consideration of matters of common concern to engineers as well as to those of public welfare, in which the profession is interested, in order that united action may be made possible." In February, 1919, and in April, 1920, the American Society for Testing Materials and the American Railway Engineering Association became respectively the fifth and sixth members of this Council.

Among some of the things that this organization has accomplished may be mentioned:

1. Furnished to Government departments four thousand names of engineers for technical duties; aided the Naval Consulting Board and the Army General Staff in examining 135,000 suggestions and inventions for war devices, and coöperated with the Fuel Administrator and the Bureau of Mines in conserving coal;

2. Helped secure exemption of engineering students from military service until the completion of their technical training;

3. Organized the Engineering Societies Employment Bureau in November, 1918, which since the armistice has registered 5,500 engineers and assistants, mostly returned soldiers and naval men, and has aided thousands to positions without charge;

4. Through a direct appeal to President Wilson, Council brought about a conference of fourteen different Government offices, engaged in map making, with the prospect of greatly accelerating the completion of the topographical map of the United States. It is now hoped to have the whole country mapped in a decade and a half; at the former rate, the Twentieth century would have ended before the map was finished.

5. Established an office in Washington January 1, 1919, under the general direction of the National Service Committee. Through this office engineers have been put in contact with the Federal Government as never before, individuals, companies, and societies have been furnished information about the activities of Congress and the departments of the Government, and useful services have been rendered to the Government;

6. Joined with National Research Council in a report on and improvement of the Patent System and Practice, on which legislation has been passed;

7. Participated in organizing the National Board for Jurisdictional Awards in the Building Industry and has a member thereon;

8. Sent delegates to Washington on the invitation of a Committee of the House of Representatives to present testimony before the committee in favor of a national budget;

9. Has recently organized a Committee on Types of Government Contracts;

10. Is studying the curriculæ of engineering schools, and making suggestions as opportunity offers;

11. Assisted the State of New York in preparing a scheme for organization of State Government.

As a result of the war experience, the American Society of Civil Engineers, in June, 1918, authorized the appointment of a Committee on Development by a resolution, the preamble of which was in part, as follows:

"Sociological and economic conditions are in a state of flux and are leading to new alinements of the elements of society.

"New conditions are affecting deeply the profession of engineering and its service to society in its various relationships to communities and nations, and in its internal organizations.

"A broad survey of the functions and purposes of the American Society of Civil Engineers is needed in order that an intelligent and effective readjustment may be accomplished so that the society may take its proper place in the larger sphere of usefulness now opening to the profession. . . .

"Any changes in organization must take into account all the conditions above indicated, and also the relationship of the American Society of Civil Engineers to other engineering organizations and to the public."

Similar committees were subsequently appointed by the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, and the American Institute of Mining and Metallurgical Engineers. The problem of these committees concerned both internal relations and external relations and in dealing with the latter, conferees were appointed from the four societies, which met in August of 1919 and organized the Joint Conference Committee. Its report in September of that year recommended "the formation of a single comprehensive organization to secure united action of the engineering and allied technical professions in matters of common interest to them" and at the joint meeting on January 23, 1920, of the members of the governing boards of the four societies, of the American Society for Testing Materials, of the members of the Engineering Council and the Trustees of the United Engineering Society, unanimously requested the Joint Conference Committee to call without delay an Organizing Conference of representatives of the national, local, state and regional engineering organizations of the country for the purpose of bringing into existence the comprehensive organization recommended by this committee.

In compliance with this request the Joint Conference Committee issued a call, in response to which there convened in Washington one of the greatest conferences of engineers in the history of this country. There were present one hundred and forty delegates representing seventy-one engineering and allied technical organizations having an aggregate membership of upwards of one hundred and twenty-five thousand. The spirit of the conference and the unanimity of purpose expressed in the formation of The Federated American Engineering Societies and the adoption of its constitution and by-laws without a dissenting vote, clearly indicates that the engineer had been aroused as never before to a sense of his responsibility as a citizen; and there was a constant expression of his desire for unselfish service in the common weal.

At that historic Washington Conference was laid the foundation for the greatest engineering organization in the world. When formal invitations to become members of The Federated American Engineering Societies had been a week in the mail, the aggregate membership of the societies that had already accepted make it the greatest engineering organization in this country and before the American Engineering Council meets it will be the greatest engineering organization in the world.

The prime underlying purpose of the organization is unselfish service to the public. That it is not organized for selfish purposes is indicated in the preamble to the constitution which is as follows:

"Engineering is the science of controlling forces and of utilizing the materials of nature for the benefit of man, and the art of organizing and directing human activities in connection therewith.

"As service to others is the expression of the highest motive to which men respond and as duty to contribute to the public welfare demands the best efforts that man can put forth, now, therefore, the engineering and allied technical societies of the United States of America, through the formation of The Federated American Engineering Societies, realize a long cherished ideal—a comprehensive organization dedicated to the service of the community, state and nation."

The organizing conference in Washington entrusted the Joint Conference Committee with making provision for putting the conclusions of the conference into effect and authorized it to act as an ad interim committee between the adjournment of the conference and the first meeting of the American Engineering Council.

Engineering Council at its meeting in June heartily endorsed The Federated American Engineering Societies and the American Engineering Council and authorized:

"Its Executive Committee to proffer and perform on the part of Council such assistance as may be practicable in completing the work of the Organizing Conference and of the Joint Conference Committee of the Founder Societies in establishing the American Engineering Council."

The activities of Engineering Council will be formally taken over by the American Engineering Council January 1, 1921. One of the important matters started by Engineering Council, which will be carried on by the American Engineering Council, is the movement to create a National Department of Public Works, which has crystalized in a bill now before Congress, known as the Jones-Reavis Bill, for the establishment of a National Department of Public Works by modification of existing departments. This bill, by concentrating the engineering and construction activities of the Government in a single department, will effect an annual saving of a very considerable amount, will eliminate duplication of effort, and so coördinate the work as greatly to increase its efficiency and place the construction of public work on a business basis, by which it may be done more efficiently both as regards its cost and time required for its completion. This movement is entirely in accord with an effort to secure a national budget in which effort Engineering Council has partici-

(Continued on page 190)

Reclaiming Salt Surfeited Soils

How a Western Problem Arising Out of Irrigation Methods Is Being Met

By George A. Dacy

MILLIONS of acres of potentially fertile and productive land—adapted propitiously for the growing of staple crops—are lying idle throughout the wide stretches of the plains and valleys of the arid and semi-arid West because they are "alkali" sick. Peculiarly enough many of these ailing soils are on the invalid list because they are surfeited with chemical salts for which many of the eastern farmers pay high prices in the form of commercial fertilizer. As it is, however, the alkali lands are so rich in their content of chlorides, sulfates and carbonates of sodium, as well as in their less bountiful reserves of calcium, magnesium and associated materials, that they are rendered unfit for cropping service due to the fact that the plants cannot survive under such conditions.

The spread of the alkali sickness is largely accomplished by the use of irrigation water as the moisture supply artificially applied in the regions of restricted rainfall is so rich in these soluble chemical salts that its continued use ultimately results in so amply stocking the fields where the irrigation water is applied with these chemicals that they become temporarily useless for further cropping purposes. As a consequence it is necessary for the irrigation farmers to exercise the greatest care and precaution relative to their water supplies. Once a western irrigated field becomes over-stocked with alkali, the only practical method of eliminating the obnoxious chemicals is by flooding the land with uncontaminated irrigation water which will carry away the objectionable and soluble salts. The usual practice is to dig deep ditches which empty over rough, untillable land and which deposit the drainage waters containing the obnoxious salts far enough away from the productive fields to reduce their potential powers of further contamination.

Farmers who wish to purchase agricultural land in the western States of Arizona, Kansas, Nevada and adjoining territory are always anxious to ascertain the alkali susceptibility or content of these soils. Similarly it is fundamentally important to find out definitely the chemical composition of various tracts of land adapted for future irrigation. It has long been desirable that some simple, economical and practical manner of testing these soils for alkalinity be devised. Uncle Sam has been vitally interested in work of this character and the investigations and resourcefulness of the scientists in his employ have been responsible for the inception of a practical test of utmost accuracy.

The Government experts have harnessed the Wheatstone bridge—familiar to all students who have studied physics—for this work. Each national soil surveyor who is engaged in soil mapping and survey work in the western country where alkali soils prevail, now carries a portable salt bridge of this description as one of the most valuable tools in his scientific outfit. The bridge is an electric resistance box in which three of the resistances are known, while the fourth is the one to be determined. A soil auger is used in obtaining a small core of soil which is then washed in a small container in order to extract the soluble salts. The solution is then transferred to a small resistance cup which is placed on the Wheatstone bridge. The operator holds a telephonic listening device to his ear and simultaneously moves the dial hand on the electric resistance box backward and forward until he strikes the point where only a slight murmur is discernible. He then reads the dial and correctly reduces the reading to parts per million of soil by reference to a standardized resistance table which is used with the salt bridge. This figure gives him the alkali content of the soil tested and indicates its adaptability for irrigation and crop production activities.

Any farmer or landowner can operate the salt bridge. It is simple and does not require the services of a scientific expert for the performance of the soil test. The simplicity of the device greatly extends the field of its practical application. It has already proved to be a prize first aid instrument in the soil survey work which the Government is performing in the arid and semi-arid regions. The farmers, ranchers, real estate agents, land buyers and irrigation promoters are also coming to appreciate the great value of this ingenious device in eliminating the gamble from their operations. Hence they are now only making wider use of this scientific test while they also are paying more attention to the reports which Uncle Sam issues officially as the result of the soil survey and mapping operations which he is supervising in the districts under discussion.

Usually in the alkali sections the runoff water from the hills accumulates in the valleys where the moisture evaporates and the salts remain. The Great Salt Lake is an example of such salt concentration. In many instances irrigated farms at the higher levels disseminate the alkalinity of the soil to places below them in the runoff irrigation water. The obnoxious condition of salt concentration and centralization is also spread by the rise of soluble salts in the ground water. Where the water table rises in this manner, alkalis which are deep-seated in the soil are often brought nearer to the surface with the resultant limitation of plant growth.

Throughout the agricultural and irrigated sections of many of the western States, the accumulations of alkali in the soil and on the surface are so pronounced as to blind temporarily those who look at the glittering, white stretches of soil. The farmers of these regions are in many cases exposed to the danger of alkaline accumulations in the soil handicapping their cropping operations, while in instances where such salt contamination does not occur, dry weather and the restricted supplies of irrigation water may seriously curtail annual production. Even after a farm is freed of its excess of alkali, the owner has to practise persistent and complete precautions to prevent his acreage from again reverting to a barren waste. However, the prodigal productivity and fertility of these reclaimed salt soils usually make it worth the farmer's effort to rid them and henceforward to keep them free of these soil-ruinous salts.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

"Unless Human Nature Is Changed"

To the Editor of the SCIENTIFIC AMERICAN:

In your June 12th issue you quote from the purported word of Lenine to the effect that human nature must be changed before the economic system under which it operates can be changed and yourself imply agreement with the statement. It is questionable that Lenine ever made such a statement. He seems too well read and practical a man to make an assertion antithetical to the facts of history. But the authorship of the statement is immaterial. It is the statement itself that is under analysis. It is a stock argument of capitalism.

It is generally conceded—and you yourself have so conceded in former editorials—that human nature is unchanged since the beginning of history. The world has had four economic systems in that time—chattel slavery, feudal slavery, competitive slavery (or system) and wage slavery (capitalism). In the first the master owned the slave bodily; in the second he owned the land upon which the slave worked and the slave could not leave the land without permission of the master, and was sold with it when it was sold; in the third the slave through the quarrels of the masters, gained sufficient freedom to permit him to fight (compete) with his fellow slave, individually in their respective lines of work, to supply the demands of the masters; in the fourth—capitalism—the master owns the job and the slave is permitted to change masters *ad libitum*—provided his purse will permit. Each of these economic systems is, relative to the slave, an improvement over its predecessor.

Human nature did not change in the transit from chattel slavery to serfdom, neither did it change when serfdom was cast aside and the competitive system adopted, or yet when capitalism came, almost like a flash, human nature remained the same.

History will repeat: "Human nature" will continue to throw off its obsolete systems and adopt better ones —and this is just what Russia—not Lenine—has done.

Lenine is not seeking to "lead" into a "land of the golden rule" as you assert. He simply recognized the fact that the old order—rather disorder—has served the time of its usefulness, that the world is ready for the new.

Your assertion that the Russian movement was an "overnight" affair is incorrect. It had been growing at least half a century. With equal untruth it could be said that the bursting of a seed pod to liberate the ripened seeds within is an "overnight" development. The fact is the obsolete pod was forced to burst by the seeds grown, ripened and ready for the change and demanding opportunity to manifest new life. So it is in Russia—so it is the world over, but elsewhere the "pod" has not been forced to burst.

Lakeside, Wash. WILL A. ROBISON.

To the Editor of the SCIENTIFIC AMERICAN:

I am glad to find the problem of human nature and the social order discussed in a scientific journal, for it is a problem in social science.

Our prevailing difficulty—that not mere scientists but even philosophers seem unable to get around—is to appreciate, first, that the "established order" is basically a survival of pre-historic anarchy in its anti-social spirit and practice; second, that human nature is not taken into account by this "order," with any view to its betterment or social efficiency; third, that were human nature the ideal thing that is commonly supposed to be a prerequisite to a perfected social order, then such a perfected social order would not be an urgent matter; we would get along comfortably together under the pure anarchy that doubtless prevailed ten thousand years ago.

It is chiefly because human nature is so very human, finite, selfish, generous, foolish, crafty and otherwise an uncertain and disproportionate quantity that a perfected social order that Russia has sought over-night, and that our own Bellamy so wisely envisioned, has been the pressing need of the last hundred years.

There has been a vast hitching up of the cart ahead of the horse, or the trailer ahead of the motor, in this discussion; for the stock objection to the establishment of business of, by and for the people has been the parrot phrase, "you can't change human nature."

In this same issue of June 12th an inventor offers yet another form of rotary motor, the ideal in steam prime movers, without making provision for any change in human nature! And therein is discussed new methods for the finishing of cement surfaces with a view to ideals in plastic artistry, and no provision whatever has been made for the conversion therewith of the human nature of cement workers! !

You can't change human nature, therefore you can, and eventually must, change the social order so that the best in human nature may be developed and rewarded, and the worst in human nature discouraged and eventually dissipated; because under such an "ideal" social order it will pay both in material and moral rewards to be good, honest, industrious, modest.

And that order—let me hasten to say—does not involve the abolition of capitalism, as our radical friends feel "ordained and called to preach"; but its installation, as the beneficent invention for the overcoming of pre-historic anarchy that it is, as a national and international function of, by and for the people—a government that will govern—to the public and the private profit.

Human nature is not so very bad; all it needs is a fair chance. It has never had it. A. GEORGE.

Hollywood, Cal.

Power from the Past

To the Editor of the SCIENTIFIC AMERICAN:

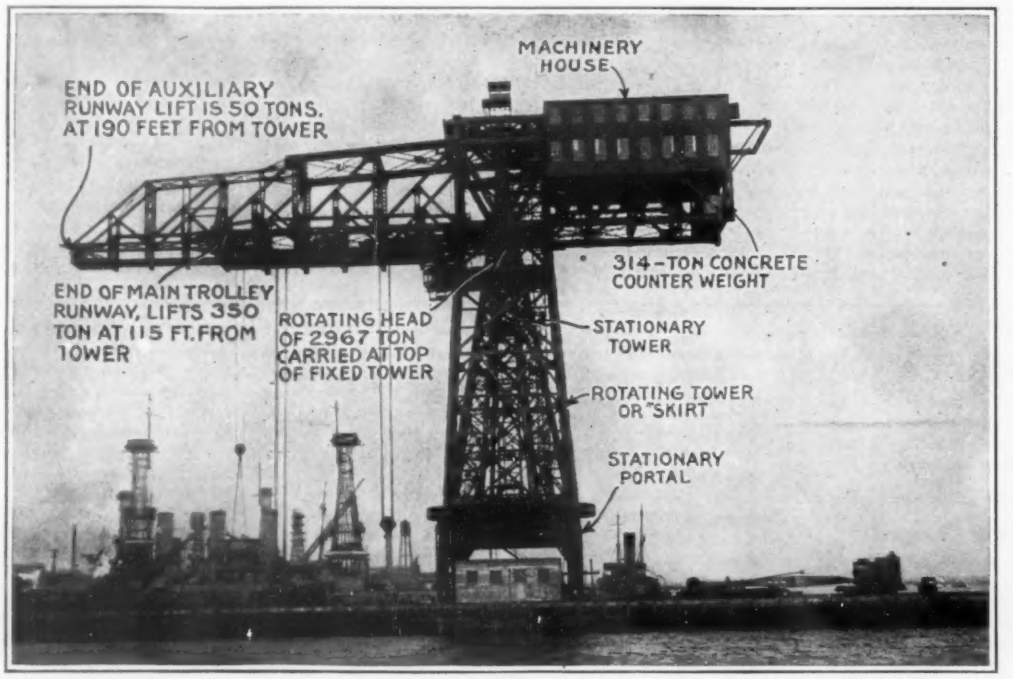
A general reader turned away from the article by C. H. Claudy, Vol. CXXII, p. 700, by its tiresome repetition of a teaching of M. Thomas Cot about "heat long ago stored for us," etc. Thinking twice would have convinced Mr. Claudy that the energy manifested as the heat of an ordinary fire was located immediately before the fire in the oxygen of the burning reaction. If this energy was put into the oxygen by the sunlight it was done when at the leaf surface, the CO_2 containing comparatively little energy, was decomposed into oxygen containing much greater energy and carbon with little if any energy. The energy thus going into the heat of the fire may as well have come from the sunlight at a nearby maple leaf, a movement before, as from the sunlight of the "prehistoric days when the coal beds were being formed."

Chicago, Ill. FRANCIS B. DANIELS.

The World's Largest Crane

How the Engineer Has Made It Possible to Lift and Swing a 350-Ton Load

THE reasons which prompted the construction of the enormous crane that forms the subject of this article are to be found in the ever-growing size and weight of the elements which enter into the modern dreadnought, and in the desire during the construction and repairs to handle these elements as a whole instead of disassembling them in order to render their lifting and transportation more easy. Thus, for instance, it has been found that in building a battleship time may be saved and the whole work facilitated if the turrets with their handling rooms are erected on the dock and placed aboard the ship in a complete condition. This, of course, means the handling of very heavy weights, particularly in the case of such a ship as the "Pennsylvania" and her class, in which three 14-inch guns are mounted in a single turret. These three guns together will weigh over 300 tons. It is customary, however, to handle the guns independently of the turret, either when the ship is being constructed or when the turret may have to be removed for repairs, but we have already adopted the 16-inch gun, weighing about 125 tons and the weight of armor carried on the turrets for such guns will be heavier than that used in previous ships. So it was decided to build a crane which would be capable of lifting out of a ship a turret with its handling room attached, placing it on shore for overhauling or repairs, and re-transferring it to the ship.



General view of the giant 350-ton hammer-head type crane, 230 feet in height, at the Philadelphia Navy Yard

This, the world's largest crane, with a capacity of lifting 350 tons on a reach of 115 feet and 50 tons on a reach of 190 feet, has been built upon a dock which extends from the bulkhead line out toward the Delaware and serves two outfitting basins. Its extreme height is 230 feet, and during its test for acceptance, its load reached a maximum of 980,000 pounds. The total weight of the rotating part of the crane with its maximum load is 5,834,000 pounds, and the total weight of the whole steel structure resting upon its pile foundations is 4,000 tons. The total cost of the crane was $871,000, and of the foundation, $120,000.

However, the mere setting down of these cold figures upon paper, and even the photographic presentment of this great work, fails to give an adequate impression of its stupendous size. It is only when one stands beneath it on the dock and climbs the steps of the central stairway to the platform 200 feet above the dock, that an adequate sense of the immensity of this great framework of steel is realized. There are other extremely large cranes of this character in the world, it is true, one in England and another in Hamburg; but the Hamburg crane, for instance, has a maximum lift of 250 tons as compared with the 350-ton lift of the Philadelphia crane.

The design of the crane was submitted to the Navy Department by the McMyler Interstate Company, and the final design was worked out in coöperation with the engineers of the Bureau of Yards and Docks. It is of what is known as the hammer-head type. The total load of 4,000 tons is carried upon an elaborate pile foundation, which is driven well down into the gravel below the overlying mud, and a lateral support to the foundation is given by a cofferdam fill. Upon this foundation was first erected the massive four-legged plate steel structure which is known as the stationary portal, the four massive legs of which support a system of deep, plate-steel girders which receive and distribute the superincumbent load. Upon the portal has been erected a central octagonal tower, the legs of which are very thoroughly braced together. This tower is finished in a plate-steel head, surmounted by a massive cast-steel cap. At the top of the cap is a turntable, consisting of a nest of horizontal steel rollers, which carries the weight of the rotating part of the structure, amounting to 5,834,000 pounds. The steel rollers are four inches in diameter, and the load works out at 3,800 pounds per inch of diameter by inch of face.

The rotating portion of the crane consists of an outer rectangular frame, known technically as the "skirt," and the overhead girders with their counterweight operating tower, runways, trolleys and hoisting cables. The skirt and the cantilever trusses are built integrally, and move as a single mass.

Now it will be evident from this description that when the crane is under load there will be a heavy overturning movement in the direction of the load, and this will result in a heavy horizontal pull at the top of the tower against the side opposite the load, and a heavy thrust against the bottom of the tower on the side facing the load. At the top of the tower the load is transferred from the moving to the stationary part by means of a nest of vertical steel rollers encircling the head of the fixed tower. These are enclosed in the same case C, as contains the nest of horizontal rollers carrying the vertical load, as above referred to. The horizontal thrust of the base of the skirt against the base of the tower is transferred from the one to the other by means of chains of vertical steel rollers. Each roller is journalled at its upper and lower ends in the links of a chain, the ends of which are secured to the bottom of the skirt or rotating tower. The rollers are carried in chains in order to secure an even distribution of load, and we are informed that the arrangement is giving the greatest satisfaction.

For lifting the heaviest weights, use is made of an equalizer bar, which carries a huge double hook at its center, and is provided with a pair of rings at each end which are engaged by the hooks on the right and left hand hoisting blocks and cables. Each of the two hooks has a lifting capacity of 175 tons, and the hook at the center of the equalizing bar has a capacity of 350 tons. The main hoisting cable leads up to two overhead trolleys, right and left. These trolleys are each carried on eight wheels and they travel over two runways extending from the tower out to the end of the main trusses, giving a reach of 115 feet. There is a third supplementary runway, which is carried by a supplementary and lighter truss extending beyond the main truss. This trolley has a capacity of 50 tons, with a reach of 190 feet.

The outboard section of the cantilever trusses carries at the outer end of its floor a concrete counterweight of 314 tons. The upper part of this section of the truss is occupied by a large two-story machinery house, in which are the 85 horse-power motors, gears and winding drums for operating the hoisting and racking cables. This operating house is itself 200 feet in the air, and is equipped with a 35-ton crane for handling the operating machinery.

An extremely interesting development, during the official tests of the crane, appeared when the four powerful hydraulic jacks at the four corners of the portal, placed there for the purpose of lifting the rotating portion of the crane, were tested out. For it developed as the pressure was increased in the pumps that, before the superincumbent mass was lifted, there was a total compression in the corner legs of the tower of 1½ inches due to the elasticity of the steel. The load lifted was just under 3,000 tons.

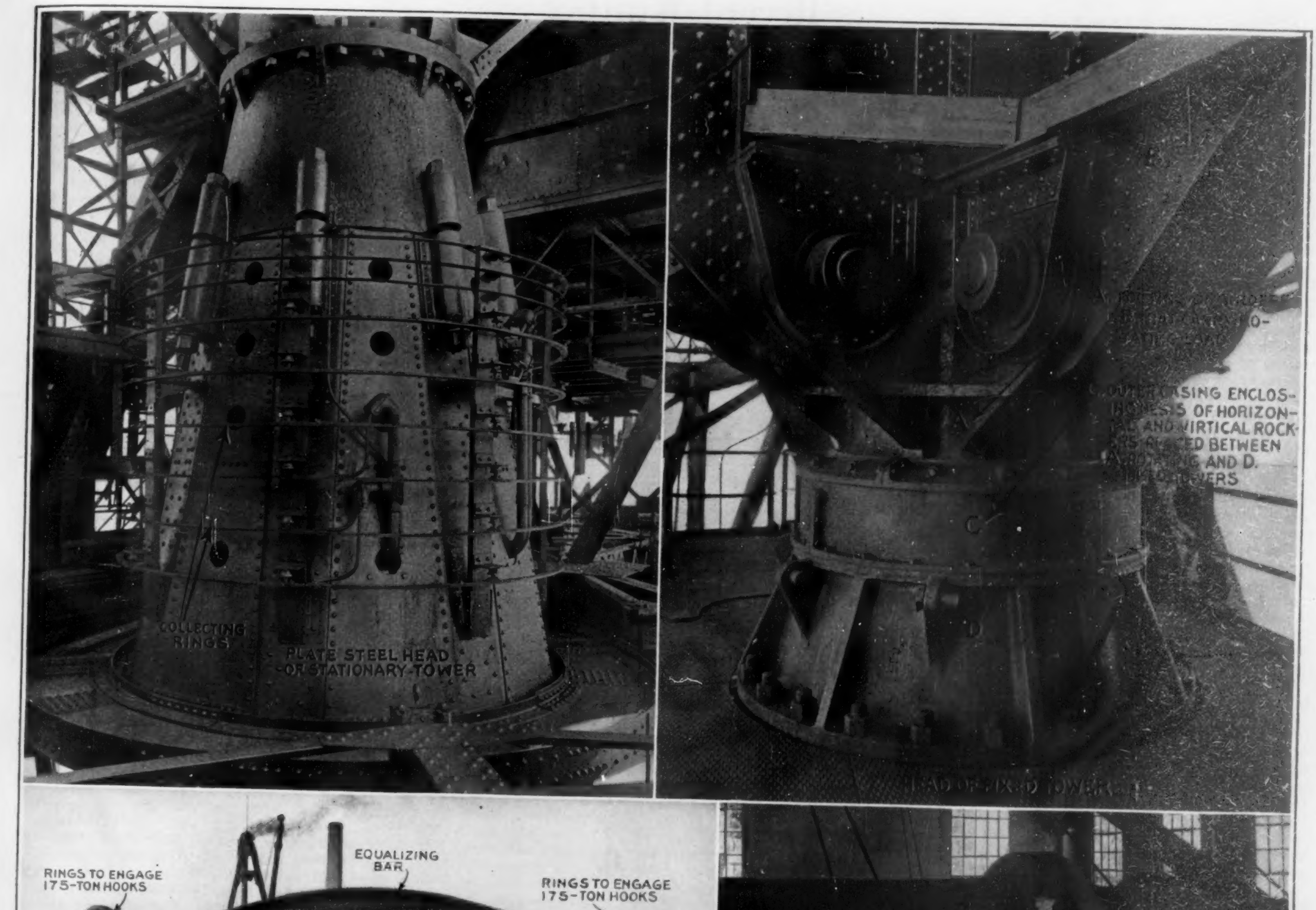
Sunstroke in Trees

EVERYONE has noticed that a very hot summer frequently causes the early withering and falling of the leaves of trees, especially of those planted in streets of cities. A much greater injury is frequently done, however, by the superheating of the bark, which is far less obvious to the casual eye. It is not too far-fetched, perhaps, to consider such an injury as a sort of "sunstroke" like that which men and animals suffer from. This sort of scorching, when it occurs, is always upon the lower part of the trunk, partly because the trunk is here thickest and, therefore, most readily heated, and partly because the cooling effect of evening is felt latest upon that part of the trunk. Pine trees and beeches growing on the edges of forests shield their trunks by a protective screen of downward hanging branches. It is often supposed that the branches of these border trees grow in this manner simply because there is more room than in the midst of the woods, but it is really a case of protective growth. Other means of protection employed by the trees against this burning effect or strong sunlight is the formation of thicker bark and a stronger layer of cork cells. These protective measures are not employed, however, by trees growing in damp locations, where uncommonly high temperatures rapidly fall when evening comes.

The substance of the wood is actually killed by this superheating of the bark, even if it only occurs in comparatively small spots; it is, nevertheless, a very serious matter, since it causes the bark to split and tear thus forming places where insects and fungi can freely enter the wood and begin their work of destruction.

This burning of trees usually occurs not during the noonday hours but in those of the afternoon, and the southwest side of the trunk is the part most often affected. A German investigator, Mr. R. Hartig, who has studied this question, according to an account in *Kosmos* (Stuttgart) found upon examining an eighty-year-old pine tree growing in the open, on an August day when the temperature was 37 deg. Cent. in the atmosphere that the living substance of the wood upon the southwest side of the tree had a temperature of 55 deg. Cent., whereas the south side was fully 10 deg. lower; the northeast side had the lowest temperature, only 36 deg. Cent. This observation involves an important principle in horticulture, namely, that when trees are transplanted they must bear the same relation to the point of the compass as they did in the original location. It is sometimes advisable to shield saplings in the summer by binding straw about their stems until the roots have taken thorough hold in the ground and the crown is well furnished with foliage.

All of which conveys the thought that the transplanting of trees is just as delicate an operation as that of transplanting the usual run of plants, despite the difference in size and the apparent difference in ruggedness. Nurserymen would do well to give this matter careful study and considerable research.



SOME STRUCTURAL FEATURES OF THE LARGEST CRANE IN THE WORLD, OF 350 TONS CAPACITY, INSTALLED AT THE PHILADELPHIA NAVY YARD

Record Weather

Excessive Precipitation, Temperature Extremes, High Winds, Blizzards, Hurricanes and Tornadoes

By Wendell M. Whiting

DURING the forty odd years that Uncle Sam has kept accurate records of the weather and received information of meteorological phenomena from all over the world there have been gathered some exceedingly interesting, remarkable and startling data.

Along the coasts of this country and also in the interior there have raged some very violent and devastating storms with winds of such great force that in many instances there could be obtained no record of the highest velocity reached because of the fact that the anemometer was blown away or destroyed.

In this hemisphere there are four types of storms that often, but not always, cause very high winds. They are popularly known as cyclones, tornadoes, hurricanes and blizzards. Tornadoes and hurricanes are at all times severe, but cyclones and blizzards need not and do not necessarily bring winds of dangerous force.

The wind velocity during the height of the average western blizzard ranges from 30 to 50 miles an hour. While a gale of that force with a temperature often far below zero is something to be avoided, nevertheless it does not rip and tear and destroy as in the case of hurricanes and tornadoes.

Pensacola hurricane, September 27, 1906. Baylen Street wharf looking southeast; also wrecked ship wharf across the slip

The most severe eastern blizzard was probably the famous one of February 11, 12, and 13, 1899. The most remarkable feature of this unusual storm was that it affected a region of the country where mild winters are the rule and severe snow storms are decidedly the exception. The States to suffer most from the elements of this storm were Virginia, Maryland, Delaware and the District of Columbia. At Washington, D. C., the lowest temperature ever recorded in that city occurred—15 degrees below zero, and the snow was between two and three feet deep with drifts anywhere from five to fifteen feet in height. Records for low temperatures were broken all over the eastern part of the country, from the Gulf coast to New York City. The wind velocity during this storm did not exceed 40 miles per hour at any time.

In the West there have been so many severe blizzards with extremely low temperatures that it is difficult to pick out any one particular storm that was worse than any other. The great blizzard that swept over the Dakotas, Kansas, Nebraska, and Minnesota on January 11 and 12, 1888, was surely as severe as any. The storm swept down suddenly from the Canadian northwest, following a very mild day and without any warning whatsoever. Several hundred lives were lost and thousands of cattle perished. The wind blew at a rate of nearly 60 miles an hour, accompanied by a thick, blinding snow and a temperature around 20 degrees below zero. At Helena, Montana, the temperature fell fifty degrees in four and one-half hours. At Crete, Nebraska, it dropped eighteen degrees in five minutes.

Houses wrecked and the debris carried to the northeast by tornado at Binghamton, N. Y., June 5, 1905, at 10.30 P. M. This time of occurrence is unusual

The West and South is the home of tornadoes. They are without a doubt the most destructive and terrifying storm we have in this hemisphere and perhaps in all the world. Tornadoes come with such suddenness that there is absolutely no opportunity to give any warning. They last only a few minutes and disappear as suddenly as they begin. They occur most often from four to five thirty o'clock in the afternoon, which is generally the hottest time of the day. April, May and June are the months of greatest frequency. The States to suffer most from these death-dealing freaks of nature are Illinois, Missouri, Iowa, Kansas, Alabama, Georgia, Mississippi, Texas and southern Minnesota. Tornadoes never occur in any of the far western States. Indianola, Tex., was twice wiped off the map by tornadoes—first during the early summer of 1875 and again on August 19, 1886.

Most people do not have a clear understanding of the difference between a cyclone and a tornado. A vast system of winds blowing around a center of low atmospheric pressure is known as a cyclone. Many disturbances of this character pass across the United States at intervals of a few days, in a general direction from west to east. They are quite commonplace storms and as they approach the temperature generally rises. After they pass cooler weather follows with west and northwest winds. Sometimes these winds reach a high velocity, especially if a very high pressure area follows the cyclone. Very high northwest winds frequently follow these storms in the region of the Great Lakes, during the winter months, and quite often there is considerable damage done to shipping.

The most conspicuous feature of the tornado is a whirling black cloud, in the midst of a mass of dark storm clouds. This cloud is usually shaped like a funnel but at times looks somewhat like a balloon. Its action is similar to a waterspout. It sweeps over a narrow path never more than half a mile wide and often only an eighth of a mile in width. Wreck and ruin, death and destruction are accomplished by the terrific forces of the whirling winds wherever this funnel-shaped whirlwind sweeps the earth. These storms are purely local, while cyclones cover a very large area and travel for thousands of miles across the continent. Tornadoes are quite often called cyclones, but this is a mistake for they have no resemblance to a cyclone at all.

The West India hurricane is the other type of storm that causes great devastation. The West Indies and the Atlantic and Gulf coasts of the United States are the regions to suffer most from these storms. They originate way down in the West Indies, from whence they get their name. They only occur from July to October. Because of the splendid system of warnings established by the Weather Bureau these storms are always kept track of, and never arrive at our coasts without at least 48 hours' notice. They generally follow one of two courses—either up the Atlantic coast, or along the Gulf coast and thence inland, where they generally wane. The general character and formation of hurricanes is very much the same as that of the ordinary cyclones.

Galveston, New Orleans, Mobile, Charleston, Savannah, and Key West are the cities that have suffered most from the furious winds of the hurricanes. Unlike the tornado the wind of the hurricane gradually increases in force and lasts from twelve to twenty-four hours.

At Cape Lookout, North Carolina, there is no telling what the record force of the wind might have been had not the anemometer blown away after registering 138 miles an hour, during the fearful hurricane that hit that part of the coast on August 17, 1879.

There are other records of very high winds reported, namely 112 miles per hour was registered on Pikes Peak, Col., in January, 1881. At Cape Mendocino, Cal., in January, 1886, a gale of 144 miles an hour was recorded and at that point the anemometer blew away. Many Weather Bureau stations along the Atlantic coast have reported wind forces of from 80 to 100 miles an hour during hurricanes and winter storms.

Some of the temperature extremes that have been recorded in this country and at other places all over the world are most remarkable and surprising. At Ouargla, Algeria, on August 27, 1884, a temperature of 127.4 degrees Fahrenheit was registered in the shade. This is the highest temperature ever recorded. The lowest temperature ever known occurred at Werchogonisk, Siberia, on January 15, 1885, when the extremely low mark of 90.0 degrees below zero was attained. Other remarkably low temperatures recorded in Siberia are 80.5 degrees below at a place called Brascht, and 78.8 below at Merchmskoe. These towns, with such jaw-breaking names, are in a region where it is almost always perfectly calm, and that very fortunate fact helps to make the intense cold more bearable.

The ordinary mercury thermometer is of no use in recording extremely low temperatures, as mercury freezes at 37.39 degrees below zero fahrenheit. An alcohol tube is generally used in cold climates.

The lowest temperature ever recorded in the United States was at Poplar River, Montana, on January 1, 1885, where the low mark of 63.1 degrees below zero was reached. More recently, lumbermen and cattlemen of the Northwest have reported lower temperatures than that, but they cannot be relied upon as the thermometers used may not have been tested instruments.

Fort McDowell, Arizona, has the record for greatest heat in this country. At that place, in June, 1883, a temperature of 119 degrees was registered. Yuma, Arizona, is one of the hottest places on

(*Continued on page 190*)

Is the Gasoline All Gasoline?

THE gasoline you use may contain impurities—possibly not, but the element of chance is never entirely removed. Not so with Uncle Sam who details the Petroleum Division of the U. S. Bureau of Mines to test all the gasoline used by the Government. If the product is not up to a high standard of excellence it is forthwith discarded.

The photograph illustrates Henry B. Cooke of the Bureau of Mines testing gasoline for the Post Office Department—hardly a retarding factor in the uncertain delivery of your mail! The apparatus, designed for this specific object, consists of a flask, electric heater, condenser, and accessories. A carbon residue instrument determines the quantity of carbon which remains after the oil is distilled to dryness. Another unit of the apparatus tells the time necessary for a certain volume of oil to flow through a specified capillary tube at a definite temperature.

The gasoline used by the Government—for example, the product employed in running the parcel-post motor trucks of the Post Office Department—is tested for the temperature of the initial boiling point and the final boiling or dry point. The results are compared with the figures specified by the Committee on Standardization of Petroleum Specifications, adopted for motor gasoline on November 25, 1919. If the fluid shows distillation temperatures above the standard temperatures at any point it is promptly rejected.

The instrument shown in the extreme right of the photograph is a closed-cup flash tester for determining the purity of kerosene and other oils. The U. S. Bureau of Mines will in the near future publish a bulletin describing the specially-designed instruments of Uncle Sam for revealing the quality of gasoline and oils used in the business of running the Government.—By *S. R. Winters.*

Special Library Census

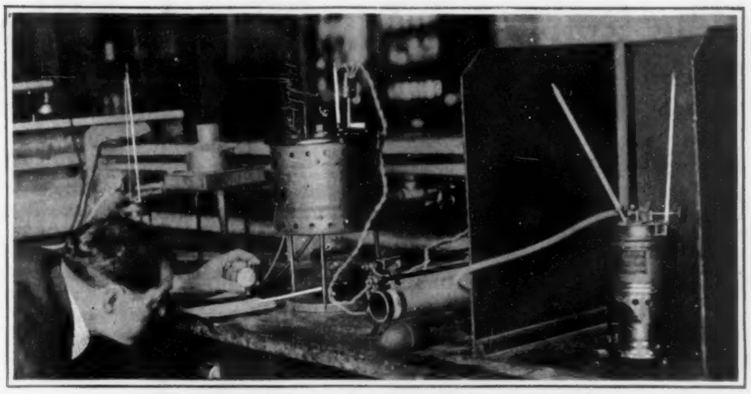
AT a time when the Government is counting up its inhabitants the Special Libraries Association is enumerating the special library collections of the country, because there does not exist at present an adequate directory of special libraries.

During the world war, when army camps and military centers were furnished with libraries for research and educational work, the men detailed to look up information for the Government were hampered by the lack of a satisfactory list of information centers which they might call upon for emergency assistance. Time and again army men could have used a directory of institutions or corporations having special information which they would permit them to consult, had such a publication been in existence.

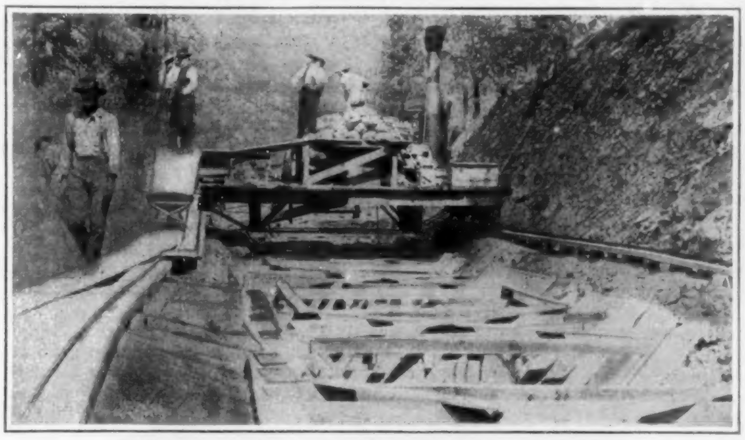
The business man realizes what it means not to have a directory of manufacturers at a time when he wishes to purchase a particular machine—and has no other way to go about it. His librarian is in just such a position when he or she is investigating a particular subject. Would it not be simpler if he or she knew of another library that had specialized on subjects of that type, and which had probably gone over the same ground?

When compiled, the directory will not be used as a mailing list for advertisers, but merely for the purpose stated, viz., to have in a central place a record of the special information sources of the country. A special library has been defined as:

"A good working collection of information either upon a specific subject or field of activity; it may consist of general or even limited material serving the interests of a special clientele; and preferably in charge of a specialist trained in the use and application of the particular material."

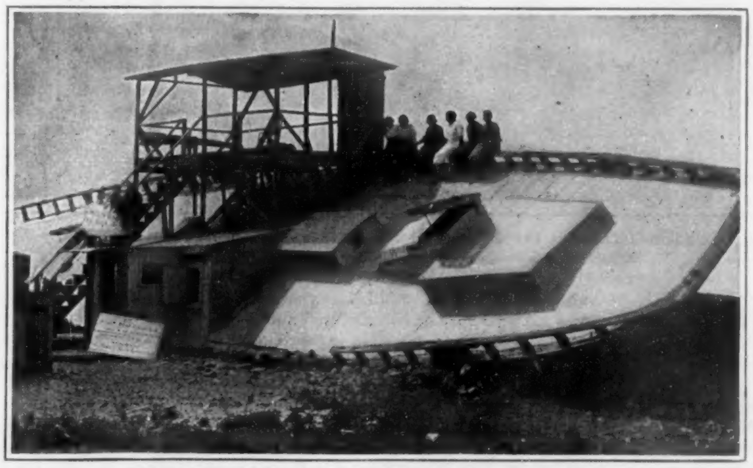


Making a test in the Bureau of Mines on a sample of gasoline



This concrete plant travels on rails to the wooden forms

Fire resistive construction in a cotton warehouse, as it appears after a serious and widespread fire



This shipwreck has been converted into a summer camp with a seaside atmosphere

If your library comes within the above qualications the S. L. A., will appreciate the following information from you:

Name of institution or company; name by which library is known; name of librarian or custodian; can it be classified as financial, business, legal, engineering, technical, institutional, municipal, reference, or agricultural; if it falls under none of these heads, the classification which you would apply to it; whether or not it serves a special clientele; would your librarian be willing to assist other special libraries to a reasonable extent?

The above data should be sent to Mr. William F. Jacob, Chairman Library Census Committee, General Electric Co., Schenectady, N. Y., who will be glad to answer any questions relating thereto.

Wheeling the Concrete Plant to the Work

THE accompanying photograph shows a novel method employed in placing concrete lining for a canal. A track was built on either side of the ditch, and on this there was run a platform supported on four flanged wheels. On this platform there was mounted a donkey engine, and the concrete mixer. Portable inclines enabled the workmen to wheel the cement and crushed rock and sand on to the platform. When the concrete was properly mixed it was run through a wooden spout into the forms directly under the platform.—By *C. W. Geiger.*

Saving the Warehouse When the Cotton Burns

FIRE resistive construction as applied to cotton warehouses has been developed to a high stage of perfection, to the extent that recently several of these buildings have withstood unusually severe fires which completely destroyed their contents without undermining or critically damaging the skeletons of the buildings themselves.

The initial cost of the reinforced concrete and steel system of construction followed in the building of fire-resistive cotton warehouses is high, but measured in terms of long-time wearability these storehouses are most durable and permanent. They are designed to favor the use of the most modern fire protective equipment and at the same time to withstand an intense and sustained fire. The accompanying photograph shows vividly how these buildings are able to resist the ravages of water and fire. Despite the fact that the entire stock of cotton was destroyed by a destructive conflagration, due to the excellence of construction and the permanency of the materials, the skeleton of the building is practically uninjured, the supporting columns, the walls, the floors and the roof, all weathering the extremes of heat, flame, smoke and water without seriously suffering from these damages or depreciation.—By *G. H. Dacy.*

Putting the Wrecked Boat to Useful Work

AGAIN we reiterate the fact that in these days of housing shortage nothing in the way of shelter is permitted to go to waste. We add to our already large collection of makeshift houses the accompanying view of a wrecked ship—the pilot boat "Columbia," which was wrecked at Scituate, Mass., during the great storm of 1898. Some ingenious person saw an opportunity of converting that hulk into a museum and charging admission. At first the museum, containing relics of the sea and illustrating the story of "David Copperfield," was operated in this ship, but later the hull was used by a group of Boston girls as a summer camping spot. The hull is wired up with electric lights and is provided with windows and hatches for light and air.

The Romance of Invention—XVI

Charles G. Curtis—The Man Who Patented Efficiency In Steam Turbines

By C. H, Claudy

INVENTORS are forever asking questions, and then going to work answering them. In fact, it is this matter of questioning the efficiency and desirability of existing things that makes for inventions, discoveries, progress. "Why not," argued Charles G. Curtis, "combine the Parsons idea of steam expansion by stages, with the De Laval idea of steam impingement and the extraction of force by allowing moving particles of steam to drive against resistance on a rotor?" This and other questions arose in the mind of Curtis. And proceeding to answer his own questions, he evolved his form of turbine, the Curtis turbine, which as a producer of power has a place all its own. But why tell about it here, when Mr. Claudy has undertaken to tell the entire story in the accompanying instalment of The Romance of Invention series.—THE EDITOR.

IT was years after the invention of the first steam engine before the idea was made practical for power purposes—literally hundreds of years. Hero, of Alexandria, is supposed to have been the first to make manifest the power of steam, his aeropile (a revolving boiler which obtained its revolutions by the impinging of jets of steam on the atmosphere) being at once the first steam prime mover and the first foreshadowing of the steam turbine of the nineteenth century.

Then, centuries later, came the steam cylinder, and for another two hundred years mankind forgot any other method of getting mechanical movement from the expansion of heated vapor of water. But there has always been the consciousness of a great waste and inefficiency in the reciprocating engine, and not all the efforts of all the inventors who compounded and duplexed, and who invented new and peculiar valve mechanisms, and more efficient boilers could get the piston and cylinder away from wastefulness.

Finally, inventors turned their attention to what is, perhaps, the oldest of all prime movers in the world—the water wheel, and considered if a steam prime mover might be made to work on the same principle. Came the first turbines, revolutionary in every sense, and a sharp division of this invention into two divisions—the De Laval type and the Parsons type.

De Laval evidently derived his idea from the undershot water wheel—that is, that the kinetic energy in the moving steam be made to give up its force by impinging upon the blades or projections of the rotor. In practice, a De Laval turbine makes a compromise between the ideal of turbine efficiency in this type—which would be reached if the speed of the blades or buckets could equal or nearly equal one-half the speed of the steam stream—and the limits of the strength of material, which forbids any such peripheral speeds as thousands of feet per second. In the De Laval type of turbine the steam expands at one jump from the full pressure of the supply to the pressure of the exhaust—it does this by being carried through a particular form of nozzle at the end of which the steam impinges on buckets in the rim of the rotor. But because the steam velocity (four thousand feet or more per second) is much greater than the possible velocity of the wheel, much of the kinetic energy of the steam stream is lost.

Parsons argued that if the steam were allowed to expand in many stages, instead of in one, and if each stage took its proportion of energy from the steam stream, a great gain in efficiency would be made—and he proved it with the Parsons turbine. In his invention, the drop in pressure is divided into many stages, and the buckets of the single wheel multiplied into thousands. Parsons also employs stationary blades so curved that the steam, winding in and out between moving and stationary blades, is made to give up energy by both its direct action or impulse and its reaction. And for many years it was thought that the Parsons type of turbine would prove the ultimate steam prime mover.

But then came Curtis with an entirely new conception of steam prime movers. Curtis believed that the De Laval principle of impinging a jet of steam on the bucketed edge of a rotating disk or wheel was the right principle. "Why not," he argued "combine the Parsons idea of steam expansion by stages, with the De Laval idea of steam impingement and the extraction of force by allowing moving particles of steam to drive against resistance on a rotor? Why not have not one, but two or three or any desired number of De Laval wheels, each with its nozzle or nozzles, and so connected and so proportioned that the relation of steam stream to rotor speed is made economical and at the same time the least possible amount of kinetic energy is lost in the process?"

It is one thing to conceive an idea, it is another to put it into execution. Experimenting with steam engines in general and steam turbines in particular is a very expensive matter. Curtis did not conceive his invention as a drive for sewing machines—he dreamed of great installations for ocean liners, of huge prime movers on land for the generation of electric power, of great turbines which would displace the large reciprocating engines as power plants in factories. To build such an engine, even of modest size, is an expensive matter. To build it experimentally and try and change and alter and rebuild is still more expensive.

However, Charles G. Curtis has methods of his own. He is a believer in efficiency and a lifelong student of getting it, whether the thing in which it is to be had is a turbine, an electric motor, a factory or the disposition of his time. At the time his invention began to take form in his mind he was associated with Crocker (later Professor at Columbia) in the C. and C. Electric Motor Co. And it is interesting to remember that it was this concern which was responsible for the fan motor. Every artificial breeze which cools the offices and homes of the world today had its beginning in this company, which conceived and carried out the design for a small, cheap, silent and efficient electric motor for fan purposes.

Charles G. Curtis, the inventor of the Curtis steam turbine which is widely employed in electric power plants and in marine propulsion

In an experimental plant in Brooklyn Mr. Curtis spent some sixty thousand dollars in experimenting with his form of turbine. To invent anything is not particularly difficult. If it has any features of novelty it is not hard to get patents upon it. But as many an inventor has found, conceiving an invention and having it patented is one thing; selling it, putting it on the market, making it pay a dividend is quite another. But Mr. Curtis had something which the world wanted, and there were men in industry big enough to see it. So the land rights to the new idea in turbines were sold to the General Electric Company, which spent over three million dollars in developing the turbine to the point where it became commercial, that is to say, where its practical working and commercial manufacture could make its principles available for the production of the maximum efficiency in steam prime movers.

It is difficult to express engine efficiency in percentages. Roughly the fuel or heat efficiency of an ordinary steam engine is less than fifteen per cent. That is, of the actual energy in a pound of coal, only about fifteen per cent is delivered in the form of available mechanical power. The reason is largely found in the absorption of energy in raising water from ordinary temperatures to the boiling point. During the expansion into steam so much latent heat is absorbed by the water in the process of turning into steam. There are also, of course, heat losses, and losses due to our inability to use all the kinetic energy in the steam. Could we utilize all the energy and have our steam escape from the exhaust of the reciprocating engine at no pressure at all—or even at atmospherical pressure—we would greatly increase efficiency, but to do this requires cylinders of such size and weight as are prohibitive in price and in friction produced. Every steam engine is a compromise between the maximum, theoretical, energy available and that which can be extracted with the greatest economy of friction, weight and expense.

The steam turbine has a higher efficiency than the reciprocating engine, the Parsons type has a higher efficiency than the De Laval and the Curtis shows a greater efficiency than the Parsons. But the advantages of the Curtis type over the other types are not only in a gain in efficiency but a gain in simplicity of construction and a great gain in practicability of use. A single point will illustrate this advantageously.

In the Parsons type of turbine there are literally thousands and thousands of steam buckets, both stationary and rotating. The clearance between them and the cylindrical casing must be very very small—in some cases as small as three hundredths or 1/33 of an inch. Make the clearance greater and there is leakage between the blade ends and the casing and an immediate drop in the efficiency of the extraction of power from the steam, for steam under pressure takes the easiest path and if it can escape *by* the blades, instead of weaving its way *through* them, it will do so, and expand without doing any mechanical work.

Now a clearance of three hundredths of an inch is a very small amount in a large turbine and the rotor and the casing must be most accurately made and again most accurately centered the one with the other, to permit the two to function with such a clearance. Consider, too, that expansion under heat must be taken care of, and that letting steam into a cold turbine too rapidly will expand the blades so that one or more may touch. This sounds innocent enough but actually it means wrecking the turbine, since the delicate blades, moving at high speed, need only a slight touch to bend over or break off, literally to churn themselves into small pieces.

In the Curtis type of turbine, where the steam is

(Continued on page 191)

Soap from Clay—A Promise of British Chemists

SOAP from clay is the promise made by a group of British chemists who have been working on the utilization of this plentiful material for a number of years and who have just established the commercial usefulness of their discoveries. Their work is being described in a series of articles in a technical paper by Prof. F. C. Weston, a leading British authority on colloidal chemistry who has been in touch with their experiments.

Stripped of all technical verbiage what this group has discovered is a method of making use of China clay which is found in large quantities both in Britain and the United States, not as an adulterant, but as an ingredient in soap making. Soap, as most people know, is made now from fat and fat is scarce and expensive and is becoming scarcer and more expensive every year. China clay is plentiful and cheap. It can be had for the digging and the process of turning it into soap-making material is cheap and easy. It is claimed that it can be used up to fifty per cent in combination with the usual fatty acids in soap making and that the soap thus made lathers as well, is as cleansing and as pleasant to use as soap made in the old way of all fat. What this means to industry may be realized when it is stated that fats for soap making cost at present in England something like $200 a ton while the refined china clay can be produced and sold at an excellent profit for something like $75 a ton.

So far, the clays used have been from the famous Cornish beds but experiments with Georgia clays have demonstrated that they can be used equally well and no doubt there are many other clays in the United States that are equally suitable.

The process by which the clay is prepared is simplicity itself. After mining it is purified by a combined washing and chemical process and the resultant finely divided clay after being run into a settling tank is dried and is ready for use. It is a soft soapy substance without a trace of grit.

The purified clay has also been used in England in the manufacture of printing inks, for color striking, and a substitute for much more expensive chemicals in the vulcanization of rubber.

Porcelain That Can Be Worked Like Glass

IT is well known both to the physicist and to the manufacturer that glass and porcelain behave very differently upon heating. While vessels of porcelain easily crack and burst and in consequence of this are not capable of taking a secondary alteration of form, most varieties of glass can be softened by heat and then bent, extended, or blown into the form desired. It is this quality of glass which is so useful to chemists and physicists in the laboratory and this is why glass is so greatly preferred to ordinary porcelain for the making of chemical and physical apparatus.

We learn from *Die Naturwissenschaften* (Berlin) that a Bavarian firm has lately succeeded in producing porcelain vessels which are highly resistant to changes of temperature. For the solution of this problem it was necesary to produce a glaze having exactly the same co-efficient of expansion as the mass of porcelain itself. In this way it was possible to obtain porcelain vessels highly resistant both to temperature and to fracture since the cracking and bursting of porcelain apparatus at abrupt changes of temperature is usually due to the creation of strains between the glaze and the mass as a result of unequal co-efficients of expansion of the two materials. These new porcelain vessels, on the contrary, can even have holes fused in their walls by an oxyhydrogen blow pipe without cracking. Moreover separate pieces of porcelain can be fused together exactly like glass, so that a porcelain tube, for example, can be fused into the wall of a dish. Finally this new porcelain can be softened and blown like glass. These qualities seem to assure it a wide usefulness.

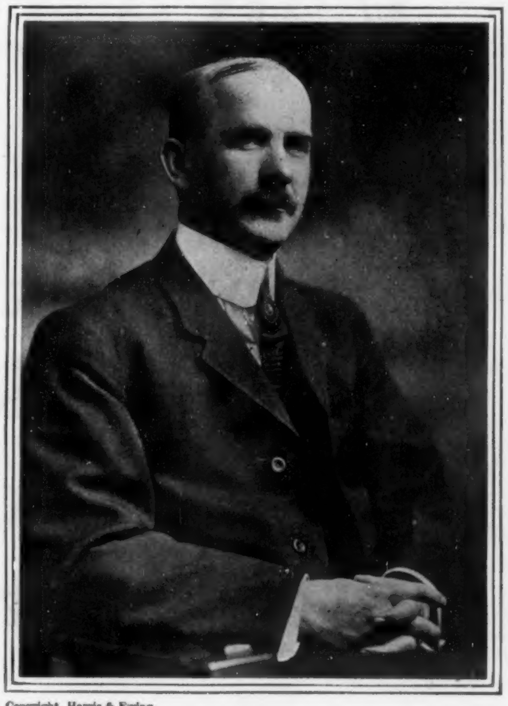
Modern Version of the " Goose That Lays the Golden Egg"

A BRITISH paper prints the following interesting story regarding "Killing the Goose That Lays the Golden Egg." Nearly a hundred years ago Charles Lamb, in one of his whimsical essays, drew attention to the fact that many an old saw has in it a half-lie as well as a superficial truth. The idea that it is foolish to kill the goose that lays the golden eggs may in future be called in question as the result ot an experience which has befallen a farmer named Blackwood whose homestead is near Calgary. Blackwood killed one of his geese one day for dinner, and what should be in its gizzard but several gold nuggets. He proceeded to kill all his other geese, favorite and otherwise, and all the ducks, and the massacre yielded many additional nuggets. Naturally the discovery of gold-mining ducks and geese has led to a great rush of buyers of these birds. Thousands that have been roaming in the country adjacent to Blackwood's farm have been sold above par and are now "gone-west." Goose, with sage and onions, and roast duck are at a discount at the Calgary hotels, and a big rush of gold hunters or duck hunters is expected as soon as the new crop of ducks has a chance to feed up. Blackwood then scraped up a couple of shovels of black sand from his farm and took it to an analyst, who reported the sand to assay 18.30 grains of gold to the cubic yard.

The New Commissioner of Patents

FURTHER evidence, if any were needed, that the Government is not competing successfully with large private and corporate interests for the services of the best men, is furnished by the resignation of James T. Newton, Commissioner of Patents, to take charge of the American business of a prominent British firm of patent solicitors. He is succeeded by Robert F. Whitehead, the thirty-third to hold this office since its creation.

Mr. Whitehead's home is in Lovingston, Nelson County, Virginia. He is a graduate of the University of Virginia, and has had also a two years' course in mathematics and physics at Johns Hopkins, one of the cradles of American science. After teaching school for five years, he entered the patent office in February, 1902, at the bottom of the examiners' ranks. He advanced steadily through the various grades, finally being appointed law examiner. In May, 1914, he graduated into the distinctively executive class through his appointment as assistant commissioner, and in June, 1916, he received the rank of first assistant. He is a member of the bar in addition to the regular qualifications to be expected of a successful patent examiner, and has been admitted to practice before the District Courts and the Supreme Court of the United States. He was married in 1904.



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The new Commissioner of Patents
Hon. Robert F. Whitehead

Mr. Whitehead will take up the duties of the Commissionership immediately upon his return from a vacation in Maine. His record is such as to inspire every confidence in his ability to take up the administration of the patent office at the point where Mr. Newton has left it, and carry forward the excellent work of his predecessor.

Alcohol Obtained from Coke-Oven Gases

WHILE in these prohibition days the possibility of obtaining alcohol from coke-oven gas in large quantities may not appear apropos nevertheless there is a practical phase which demands attention because of the prospect in relation to the motor fuel supply of the future. According to a paper read before the Cleveland (Ohio) Institution of Engineers the importance of this source of alcohol appears in the fact that one ton of coal yields 1.6 gallons of absolute alcohol. Thus the possible gain of alcohol from the coke-ovens of this country is 23.4 million gallons a year. If the gas-works were to recover their possible ethylene an additional 27,000,000 gallons would be available. This would leave the situation for motor-spirit as follows: Gas-works, 34,000,000 gallons of benzol and 27,000,000 gallons of alcohol; and coke-oven plants, 30,000,000 gallons of benzol, and 23.4 million gallons of alcohol; total, 114,400,000 gallons against 160,000,000 gallons required.

It was clear from the outset that whether charcoal or sulfuric acid was to be used in the purification, the recovery of ethylene and the manufacture of alcohol derivatives could not be made to pay unless the fuel expenditure was cut down to a minimum. This end is attained by utilizing waste heat. The point has been raised that with the removal of the ethylene from the coke-oven gas the calorific value of the gas will be seriously lessened. An investigation of the question has shown that when all is taken into account this loss of calorific power is negligible—only 1.1 per cent. Hence it is evident that the heating of the ovens will not be seriously affected. The processes described involve no new principle. The reactions are well known and therefore may be accepted without discussion. All that is claimed is the application of these reactions to industrial practice in the preparation of cheap alcohol from coal.

There are, however, certain new features in the carrying out of these processes, which features make for the success of the system.

Effects of Manure Scarcity

ONE of the big subjects among Boston market gardeners nowadays is the question of location. Up to the advent of the motor truck, market gardens to supply the Boston demand were automatically kept close in, and as the available area of suitable land was limited it commanded a very high price, while its control placed the owning or renting gardener in a strategic selling situation. The motor truck tended to drive the market gardens farther out, and now there is another much talked of factor, the scarcity of stable manure.

The scarcity of stable manure, a consequence of automotive displacement of the horse, grows more and more serious. The heavy Boston supply, which formerly liberally supplied the market gardens, has fast diminished. Its further curtailment is anticipated. On any intensively cropped land, fertilization is a vital matter, and with stable manure supplies cut off, an immediate remedy is imperative.

It seems certain that entirely new fertilization methods will come into use. One method seriously considered at this time involves the use of gardens of larger size considerably farther out, trucks being relied on to get produce to market in time. Larger farms would enable the gardener to grow crops for green manuring, which, with the aid of artificial fertilizers, would meet the problem. The Rhode Island Experiment Station has conducted tests along this line which indicate it is practical, using green manures and chemicals, to dispense with stable manure in large part, or wholly.

This is a strong argument for the removed location, and there is just one serious objection to it. That is the labor question. Italian labor is mainly depended upon by Boston market gardeners. The laborers will work at a point reached by a short trolley ride, but refuse to go farther out. The consequence is that despite the stable manure shortage, recognized as permanent, Boston gardeners are still somewhat at sea over the question of location.

New Application for Metal Spraying

THE metal-spraying process appears to have found a new application in engineering practice, according to an article in a German technical paper. It seems that the sand contained in the water jets supplying Pelton wheels may pass through the finest screens and still be sharp enough to destroy the buckets. Observation has revealed the fact that the sand-blast does not remove lead covering from iron, and it is therefore proposed that buckets for Pelton wheels should be lead covered by means of the so-called spraying pistol, in which a lead wire is fed automatically into an oxy-gas blowpipe and sprayed as a fine cloud of molten metal by the force of the gases. Lead applied in this way adheres very firmly to iron and steel as the minute particles are projected with great force and actual metallic contact is obtained, which is not the case when ordinary dipping processes are employed. Presumably the lead forms a sort of amorphous surface layer sufficiently elastic to counteract the erosive action of the sand particles.

The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W. PAGÉ, M. S. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

Special body adapted to the delivery of ice cream

Speedy Ice Cream Delivery

EVERYONE has observed trucks or wagons with loads of cracked ice and freezers of ice cream standing in front of a drug store or soda fountain and no doubt has noted the stream of water running over all under parts of the truck. This is particularly hard on the springs, frames and other smaller parts under the body.

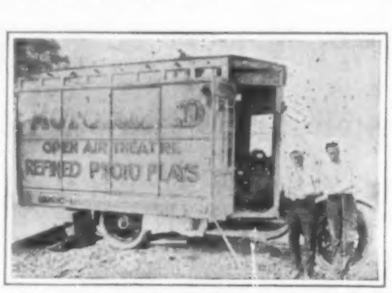
An ice cream company of Milwaukee operates two two-ton trucks with bodies well adapted for this work. Three compartments, metal lined, are provided for ice or containers and another for salt. Partitions can be set in in order to facilitate the handling of brick ice-cream or regular freezers. Space is left in the center of the body which enables the driver to unload large containers with ease. Drain pipes lead from each compartment and these carry all water well below all the truck parts. A truck has just been purchased by another concern for this work, this one to have pneumatic tires for speedy delivery, which is shown in accompanying illustration. This also has a special body for carrying the ice and is fitted with drip pipes so the corrosive, salty water will not leak out of the body at points where it can collect on the machinery. The special body construction illustrated not only saves the truck mechanism from untimely depreciation but greatly facilitates the handling of the ice cream containers and the speedy delivery service is greatly appreciated by the trade.

Repair Shop Trucks for Fleet Owners

MOVING repair shops, mounted on motor trucks, which were extensively used by the Government during the war to care for its large fleets of trucks at home and abroad, are destined to play an important part in facilitating the successful operation of the ever-increasing fleets of trucks operated by large companies, contractors and road builders throughout the country. With the increasing use of fleets of trucks in various lines of business, the machine shop truck, as a flexible medium for keeping fleets of trucks in constant running order, at a minimum loss of time, will become as necessary and vital a factor for commercial use as it was during the war.

The continuous operation of every truck is an important consideration with a fleet owner and in this respect the machine shop truck has proved itself a time and money saver through its ability to go direct to the crippled truck and put it in shape at a minimum of time. Mounted on the chassis is complete equipment to handle any kind of repair job. A separate motor furnishes the power for operating the various machine tools. This embraces such mechanical apparatus as a drill press, screw cutting lathe, electric grinder, blow torch, welding outfit, forge and more than 1,000 other pieces of machinery and tools.

Each tool and piece of machinery has its own location, insuring compactness when the end and side panels are up and the truck is in motion. The fact that a great number of these moving repair shops were furnished the Government during the war is proof of their value in caring for fleets of trucks. With the increasing tendency to operate fleets of trucks in various industries, the efficiency of the machine shop truck will soon make it an important factor with every fleet owner.



A complete motion-picture equipment is carried in this large truck

Motorized Open Air Theatre

MOTION pictures on wheels is one of the latest developments designed by Messrs. De Pathy and Bergstrom of Hartford, Conn., the apparatus for which is shown in the accompanying photograph. In this motorized open-air theater bus are a motion picture machine, equipped with a 32-volt gas-filled lamp, a 1-kw., 40-volt, 1,700 r.p.m direct current generator and miscellaneous equipment. The generator is driven by a fabric band on the engine flywheel. The pictures are projected through an opening in the rear of the bus on a screen 40 or 50 feet distant, which may be stretched on any convenient building or between posts and trees. The owners intend to visit small towns and villages which do not support moving picture theaters, yet which have sufficient population to support an occasional performance. The expenses of operation will be materially reduced over that of running even a small theater and a regular route can be established so the latest thrillers will be brought to an amusement-loving public who would otherwise be deprived of this popular means of recreation. The truck is decorated in bright colors and serves to advertise the enterprise.

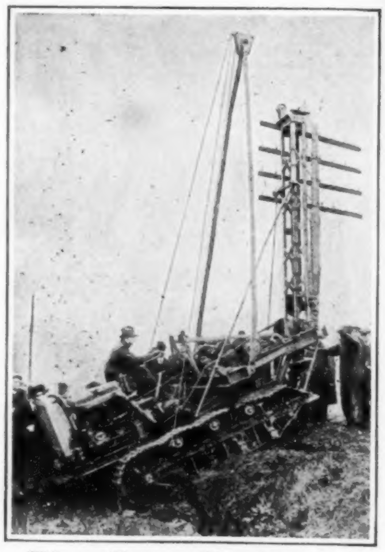
Motor-Driven Wagon Loader

THE accompanying illustration shows a useful piece of machinery for coal dealers, contractors and others who use motor trucks for hauling such materials as sand, loam, crushed stone, coal, etc., which must be loaded from piles on the ground to trucks. The machine is a bucket type conveyor, the chain of buckets being driven by mechanism mounted on the loader chassis. Either an electric motor or a small gasoline engine may be used as a source of power for the conveyor to suit individual requirements. The conveyor mechanism is arranged so it can be adjusted for materials of various kinds and for different sizes of piles. Gearing is provided so the conveyor can be fed into the pile by its own power. The wheeled truck makes it easily moved. Needless to say, a machine of this nature will replace a considerable number of men at a marked saving. This combination of two familiar elements—truck and conveyor—is plainly a very happy one, and one that adds much to the utility of each. The independent source of power for the conveyor is a particularly good feature, since it makes it unnecessary to connect and disconnect between truck engine and driving gear of the conveyor each time the truck is filled and replaced by another.

The motor-driven loader saves much time in operating a motor-driven fleet

Combined Tractor and Earth Boring Machine

THE accompanying illustration shows a field test on a recently devised traction engine which carries an earth boring machine used in drilling post holes. The machine proper consists of a structural iron frame carrying a shaft on which a large post hole auger is mounted. This can be fed down into the ground to make a hole of the required depth. This auger, which is carried on a vertical shaft is driven by chains and gears from the main power plant. The engine is the usual four-cylinder, overhead valve type that is very popular for tractor work and transmits its power to an auxiliary transmission controlled by clutch levers placed conveniently to the driver.



This machine expedites the work of boring post holes anywhere

The entire mechanism is mounted on track laying traction members which not only makes it possible for the machine to maneuver exceptionally well on soft and rough ground but it also provides a large area of ground support for carrying the heavy propelling and earth boring mechanism. The frame carrying the auger can be set to drill holes at any desired angle when the machine is level, or to drill straight holes if the machine is tilted, which is inevitable if the machine is on a bank or high hill. The tractor not only carries arrangements for boring the post holes expeditiously but also has a triangular derrick boom so it can be used for setting the poles after the holes have been made for their reception. The value of a machine of this kind and its labor-saving possibilities can only be appreciated by contractors who have undertaken the task of setting out miles of pole lines by the usual methods.

The moving repair shop as it looks when on the go, and the same truck set up ready for work

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farming Implements, Etc.

Of General Interest

FOLDING UNIVERSAL TABLE.—A. W. Lee, Rockwood Hale, Tarrytown, N. Y. Among the objects of the invention is to provide a folding table of light and simple construction and having its parts so positioned and arranged that the table, when not in use may be folded to occupy but little space and will have its various parts carried therein. The table is particularly intended for use in automobiles or vehicles and for campers, the legs are adjustable and all movable parts are held firmly in position.

MOP HEAD.—I. M. Kaufman, 601 Howard Ave., Brooklyn, N. Y. The object of the invention is to provide a simply constructed mop head in which the principal feature is the adaptability of the mop head to thick or thin mop cloths. The device comprises a frame, a cloth holding bar rotatably mounted to receive varying thicknesses of cloth, and means for clamping and holding the bar in position.

FOUNTAIN BRUSH.—W. Grace, Hellabys Bldg., Queen St., Auckland, New Zealand. The invention is adapted to be embodied in brushes for various purposes, such as toothbrushes, shaving brushes, shoebrushes and the like. More particularly the invention relates to a fountain brush involving a reservoir or container adapted to receive a replaceable refil cartidge containing plastic or other material to be delivered to the bristles, feed means being provided to cause the paste or other material to be extruded as required.

SALVAGING APPARATUS.—C. Sanger, St. Louis, Miss. The invention relates to the salvaging of sunken vessels and the like. The prime object is to provide a tank capable of being submerged by filling the same with water which is subsequently discharged from the tank to render it buoyant. A further object is to so construct the tank that it contains suitable means for discharging the water and means for controlling the discharge.

APPARATUS FOR TEACHING ARITHMETIC.—R. A. Jackson, Springfield, N. J. The object of the invention is to provide an appatus for enabling teachers of arithmetic to readily test the scholars as to speed and accuracy in solving arithmetical problems. Another object is to provide a simple apparatus arranged to disclose a great range of arithmetical problems in addition, subtraction, multiplication and division, and to permit the teacher to quickly change from one branch to another and to vary the problems.

HOSE REEL.—G. L. Perrine, Hillsboro, Ore. The invention has for its object to provie a device wherein the hose may be permanently connected with the source of water supply while on the reel, to permit as much of the hose as may be desired to be withdrawn from the reel for use without interfering in any way with the flow of the water. The reel might be used in connection with air hose as well as water hose.

YOKE OR SHOULDER WEIGHT CARRIER. R. P. Orr, 35 So. Manning Blvd., Albany, N. Y. This invention relates to weight supporting means for the shoulders of a person and has for an object the provision of a construction adapted to fit against the shoulders in such a manner that the weights connected therewith will be supported evenly over the entire shoulders, the arrangement being such that weights may be positioned so as to be supported by either shoulder or both shoulders simultaneously.

CARRIER RECEPTACLE.—R. P. Orr, 35 So. Manning Blvd., Albany, N. Y. The object of this invention is to provide a carrier receptacle with a number of compartments which may be easily supported while at the same time arranged to present easy access. Another object is to provide a carrier receptacle for mail carriers, soldiers, and other parties desiring an easy means for carrying one or more articles.

JUVENILE PRINTING BLOCK.—Caroline Monteith, 117 Scotland Road, So. Orange, N. J. The object of the invention is to provide a printing block for teaching children or beginners to read without the usual formal exercises by utilizing the natural activities and powers of children as they play and the art of printing their own reading material.

TAILORS' ORDER BLANK.—H. C. Dixon, Lodge No. 946, Protective Order of Elks, Tulsa, Okla. The invention has for its object to provide a blank of the character specified which, in addition to a complete record of the customer's measurements, will furnish one or more photographic views of the customer in order that the tailor may have before him a photograph showing the physical peculiarities of the customer.

ENVELOP.—W. Hire, 297 Glendale Ave., Detroit, Mich. The object of the invention is to provide an envelop formed from a single piece of material so folded and secured as to provide a plurality of separate pockets, the specific arrangement of which is that they are adapted to contain different matter for mailing such as catalogues or circulars, it being possible to use circulars and catalogues of different sizes, which will reach their destination at the same time.

APPARATUS FOR EXTRACTING GREASE FROM ORGANIC MATTER.—K. A. Stahlgren and T. L. Shannon, address Thos. L. Shannon, 19th and Providence Ave., Chester, Pa. An object of the invention is to provide an apparatus for extracting grease from garbage and other organic matter in an exceedingly simple and economical manner. Another object is to provide a large heating surface for effectively heating the organic matter and at the same time insuring a thorough agitation of the matter and the solvent used to reduce the time of drying the organic matter and extracting the grease.

BELL RINGER.—L. La Munyon, Shoshone, Idaho. The invention relates more particularly to a construction and arrangement of striking device which may be utilized in connection with a bell, such as a fire alarm, an object being to provide a hammer which comprises a leaf spring and to which an oscillating movement is imparted causing a rapid and continuous vibration of the free end of the hammer.

FRUIT PITTER AND CUTTER.—W. N. Risden, Watsonville, Cal. An object of the invention is to provide a simple apparatus which will at a single revolution of the drive shaft operate to sever or cut the fruit in half and at the same time cleanly cut out the pit of the fruit. Another object is to provide a device which can be manufactured and sold at a reasonably low price.

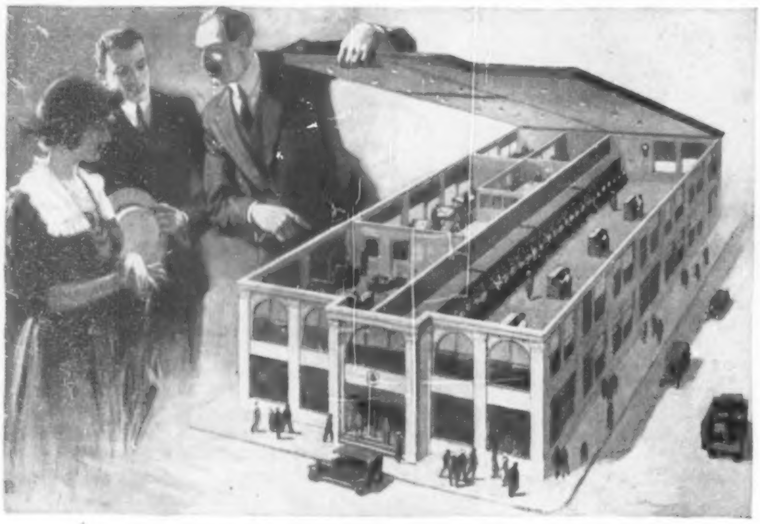
FOLDING BOX.—P. A. Hoffman, c/o Smead Mfg. Co., Hastings, Minn. The invention relates to folding or knock-down boxes and more particularly to a folding box used for the mailing of currency and valuable securities, such as bonds, notes, mortgages, etc. The general object is to provide a folding box which can be variously folded to produce different capacities of receptacle whereby the box may be made to exactly and tightly fit its contents. A further important object is to provide for the proper sealing of the ends.

EYEGLASS CASE AND CLEANING DEVICE.—R. A. Goelkel, 601 W. 137th St., New York, N. Y. The object of the invention is to provide a combined eyeglass case and cleaning device, whereby substantially any sized or shaped eyeglasses may have the lenses wiped while still in the case by a member having a rotary movement which is transmitted to the glasses so as to move the same over suitable wiping surfaces.

CAMERA.—K. Chen, 75 Baikal Road, Shanghai, China. This invention relates more particularly to cameras of the reflex type, and has for its principal object to provide means whereby in case of necessity a wide angle lens may be employed. The invention aims to make the use of a wide angle lens possible by providing a slotted opening forward of the mirror to receive a ground glass in a frame for focusing, or in its place a conventional plate holder.

SWAGGER STICK.—E. L. Yungk, 9 Elliott St., Hartford, Conn. An object of the invention is to provide a toy novelty which will be attractive in appearance and which will have an appealing influence upon holiday and festival occasions where celebration is engaged in by people of all classes. A further object is to provide a toy comprising what is known as the swagger stick and an audible tone-producing device and decorations.

HEEL.—A. H. Sommers, 225 Hamilton St., Allentown, Pa. This invention relates to fastening means for effectively securing the heel to the shoe. An important object is to provide a device of this character especially



adapted for use with ladies' high-heel shoes and which will effectually secure the heel and prevent breaking away of the heel from the sole at the point of attachment or of the plies of the heel from each other adjacent to this point.

Machines and Mechanical Devices

HYDRAULIC MOTOR FOR CHURN OPERATING DEVICES.—A. Roos, 1432 W. Monroe St., Chicago, Ill. An object of the invention is to provide a simple device by means of which water, as, for instance, that derived from a village water supply, may be utilized for operating the churn. A further object is to provide an adjustable device to meet the varying conditions of churns of different sizes or heights, and rooms of different sizes. The device is simple, having few parts, and therefore not liable easily to get out of order.

CAM AND PUSH ROD MACHINE.—J. Holle, 389 So. Belmont Ave., Newark, N. J. This invention relates to a cam and push rod mechanism for puppet valves and other devices and has for an object a device wherein a greater throw is provided by the same type of cam. Another object is the provision mechanism so arranged that the push rod will engage substantially flatwise against the face of the cam, and as the parts move the same will gradually move off the push rod on to the roller so that the push rod may return in easy manner over the rounded rear surface of the cam.

Pertaining to Vehicles

VEHICLE SPRING SHACKLE.—J. J. Crawford, West New Brighton, S. I., N. Y. The object of the invention is to provide a spring shackle more especially designed to connect the eyes of a pair of semi-elliptical leaf-springs with each other and arranged to act as a shock absorber and to guard against breaking of the spring members. Another object is to absorb the minor vibrations and jolts incident to the vehicle running over rough roadways.

TRACTION WHEEL.—O. R. Hanson, Cadogan, Alberta, Canada. This invention relates more particularly to traction engines, whose wheels as now formed have broad flat treads, the object being the provision of simple means capable of ready adjustment to the wheels for the purpose of generally improving traction with either hard or soft ground, or traction surface which may be readily installed and which is capable at all times of efficient action and ready repair.

LOCK FOR TIRE CASINGS.—T. E. Cook and A. T. Freije, Rincon, N. M. This invention relates to locks for tire casings, and has for its object to provide mechanism to be used in connection with wheels having clencher rims for locking the shoe or casing to the rim in such manner that it cannot be removed by unauthorized parties. To prevent the removal of the casing a plate is provided which is shaped to fit upon the adjacent edges of the casing, within the same, to hold the edges of the casing from inward movement and thus prevent displacement.

VEHICLE.—L. Nussbaum, address Henry Shade, Quail and Elk Sts., Albany, N. Y. This invention has reference more particularly to an impellent ice or snow vehicle which includes runners with a frame made to accommodate an occupant who may thrust or push the same ahead by an impeller or the like. The primary object is to provide a simple, durable vehicle which may be manufactured at a low cost.

TEMPERATURE INDICATOR FOR AUTOMOBILE RADIATORS.—W. F. Jenkins, 1814 Hanover Ave., Richmond, Va. Among the objects of the invention is to provide an indicator which will exhibit a column of steam to the driver of the automobile immediately the radiator begins to boil, and to provide a radiator cap with means whereby the steam will be exhibited, so that the driver will be informed either in the day time or at night of the fact that the water is boiling.

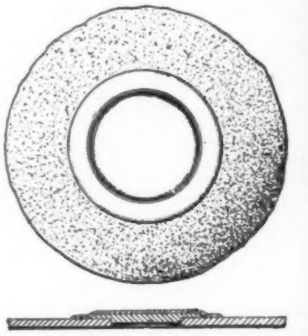
REBOUND CONTROLLER.—H. G Craig, R.F.D. No. 5, Washington Court House, Ohio. This invention has for its object to provide a device adapted to be arranged between the frame of a vehicle and the axle for controlling the rebound to prevent shock and jar, wherein the arrangement is such that the device offers no impediment to the compression of the spring, but cushions the expansion, and wherein the cushioning action may be varied.

TRACTOR WHEEL.—C. A. Slocum, 534 Milwaukee St., Denver, Col. The invention relates more particularly to a tractor wheel comprising a revoluble but rigid inner member surrounded by a revoluble but flexible outer member, the latter being so arranged that by distortion of its shape while in action it will spread out upon the ground and thus give a relatively large bearing surface, and consequently a better tractile effect.

TRAILER.—F. B. Allen, Joplin, Mo. The general object of the invention is to provide a trailer having a longitudinal bearing through which is disposed a guide pole adapted to be articulated to the rear of a truck, draft means being secured to the pivot of a bolster on the trailer and being adapted to be secured at the pivot to a bolster on the truck.

BICYCLE PUMP LOCK.—A. P. Lundin, 1491 *a* Xitchner Ave., Bey Valley, Johannesburg Transvaal, South Africa. A particular object of the invention is to provide a locking means permanently secured to one frame bar of the bicycle and positively locking the pump thereon to prevent unscrupulous removal. The device is so constructed that it will positively engage the pump and will automatically move out of engagement when the lock is opened by a key.

PROCESS OF VULCANIZING.—T. A. McAllister, 586 Broad St., Augusta, Ga. The invention relates to a process of vulcanizing, as for instance in the repair of pneumatic tubes and the like wherein it is impracticable or undesirable to place a backing of vulcanized rubber on the reverse of the tube to be repaired. The process consists in cementing to the outer face of the tire a sheet of vulcanized rubber and in placing raw rubber on the outer face of the sheet and vulcanizing the rubber.



A TRANSVERSE SECTION AND PLAN VIEW, SHOWING THE PROCESS COMPLETE

EMERGENCY TIRE.—H. M. Shannon, Richmond, Tex. An object of the invention is to provide an emergency tire adapted to be quickly and easily applied to the automobile rim. Another object is to provide an emergency tire having high cushioning properties closely approximating the qualities of the pneumatic tire, the construction and arrangement being such that the device may be cheaply and easily manufactured while preserving strength and durability.

TRUCK.—J. T. Hall, 317 No. 11th St., Waco, Tex. This invention has for its object to provide a truck especially adapted for railroad use, as for instance, in handling baggage, freight or the like, wherein the supporting wheels are so arranged with respect to the body that they may be moved longitudinally thereof to permit the end of the truck to rest directly on the ground in loading, or to raise the body of the load well above the ground during transportation.

Designs

DESIGN FOR A GEM SETTING.—W. Fischer, 67 Courtlandt St., New York, N. Y.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—A. Flint, 267 5th Ave., New York, N. Y.

DESIGN FOR A PENNANT.—A. E. Langlois, 121 Hathaway Ave., New Bedford, Mass.

DESIGN FOR A BADGE.—D. E. Victor, 505 5th Ave., New York, N. Y.

DESIGN FOR A PURSE.—C. A. Nichthauser, 32 Union Sq., New York, N. Y.

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SUBSTANTIAL manufacturing corporation wants capable men to establish branch and manage salesmen. $300 to $2000 necessary. Will allow expenses to Baltimore as explained. Address, Mr. Clemmer, 603 N. Eutaw St., Baltimore, Md.

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A LABOR SAVING office appliance, having unlimited market, covered with basic (allowed) patent claims, with dies, patterns and parts ready for immediate quantity production (representing expenditure of about fifteen thousand dollars). Owner will consider offers for license, outright sale, or legitimate promotion. Address Office Appliance, Box 115, care SCIENTIFIC AMERICAN.

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Is There a Coal Shortage?

(Continued from page 174)

All these things have heaped coals of fire upon the heads of the men who are responsible for the coal supply of New York's public utilities. Said one executive:

"I used to pay no attention to the coal problem excepting once a year when we renewed our contracts. Now I have to be constantly on the alert to prevent a shut-down of our system."

Realizing the delicate position of New York's public utilities with regard to a coal supply, and the terrific consequences of a shut-down, the Interstate Commerce Commission has granted priority to coal shipments to these concerns. For the present, at least, their coal problem seems solved and responsible executives say they have no fear of a coal famine next winter, unless some new circumstance intervenes.

All of this, however, takes no account of the industries which are served with coal that comes to or through New York. These present quite a different problem.

Few industries buy as much coal or as steady a supply as do the public utilities. As a result they find greater difficulty in buying coal at all and far greater difficulty in having it delivered. Such fuel is subject to seizure by the carriers and great quantities of it never reach their destination.

As a result, many of the industries have pooled their coaling facilities. Not only do they buy through a common agency, but they exchange coal among themselves by common agreement. Thus the manufacturer who has an excess of coal will come to the aid of the man who has none.

One such association, the Tidewater Coal Exchange, handles about 1,250,000 tons of coal monthly. The exchange was formed during the war to facilitate the handling of coal, as a patriotic measure, and has been continued as the beneficial results became apparent.

The Exchange classifies all coal coming to it and each classification is numbered, such as Pool No. 16 or No. 25. Members establish a credit by shipments to a certain pool or pools and they may then draw upon these pools for their supply. In special instances and in emergencies they may draw their coal from the pool before their shipment has actually arrived, or they may even draw out more coal than they have credit for. Credit in one pool may be transferred to another. The arrangement, on the whole, is a very flexible one and has practically eliminated the coal troubles of the firms who are members.

The greatest advantage of this arrangement, from the standpoint of the public, is that the movement of coal cars is greatly expedited. Cars do not have to stand on sidings until the consignee can unload them, but they are unloaded by exchange employees and the cars are immediately returned to the mines. A system of inspection and supervision is maintained by the exchange to protect the shipper and to speed delivery.

Officials of this institution say they are having no difficulty now in buying coal at the mines. As in the case of the public utilities, the principle difficulty is in transportation.

The general impression that a serious coal shortage exists or impends is no doubt fostered to a large extent by the abnormally high prices the householder and the small user of coal have to pay. The wide discrepancy that exists between the cost to very large consumers, and the cost to small users suggests that there is room for investigation. The basic costs are the same in each case. That is, the costs at the mine, haulage costs and insurance do not differ for coal users large and small, in the same locality. But the fourth item of expense—*profit*—may vary widely.

Since the large coal users are able to buy most advantageously and since they

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in this new way—remove the film

All statements approved by high dental authorities

Millions of teeth are being cleaned in a new way. You see them everywhere — glistening teeth — teeth you envy, probably.

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Dental science has discovered that film causes most tooth troubles.

Film is that viscous coat which you feel with your tongue. It clings to teeth, enters crevices and stays.

Much film escapes the tooth brush. The ordinary tooth paste cannot dissolve it. A soapy tooth paste makes it more viscous. So very few people escape tooth troubles despite the daily brushing.

It is the film-coat that discolors—not the teeth. Film is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

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Now we combat it

For years that film has been a vital problem. It is removed by dental cleaning, but in the months between it may do a ceaseless damage. And we have seen tooth troubles constantly increase.

Now science has discovered an efficient film combatant. Able authorities have proved it by many careful tests. Dentists have long employed it. And for home use it is now embodied in a dentrifrice called Pepsodent.

You can quickly know

You can quickly see the Pepsodent effects. This ten-day test reveals them. And the book we send explains all the reasons for them.

The film is albuminous matter. So Pepsodent is based on pepsin, the digestant of albumin. Its object is to dissolve the film, then to day by day combat it.

This method long seemed impossible. Pepsin must be activated, and the usual agent is an acid harmful to the teeth. But science has discovered a harmless activating method. And now millions of people every day combat the film in this way.

Pepsodent combines three new methods to meet modern dental requirements. We urge you to try it. See what these new methods mean, both to you and yours. Cut out the coupon so you won't forget.

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Now advised by leading dentists

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Look in 10 days

Send this coupon for a 10-day tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how they whiten as the film coat disappears. It will be a revelation.

10-day tube free

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Mail 10-Day Tube of Pepsodent to

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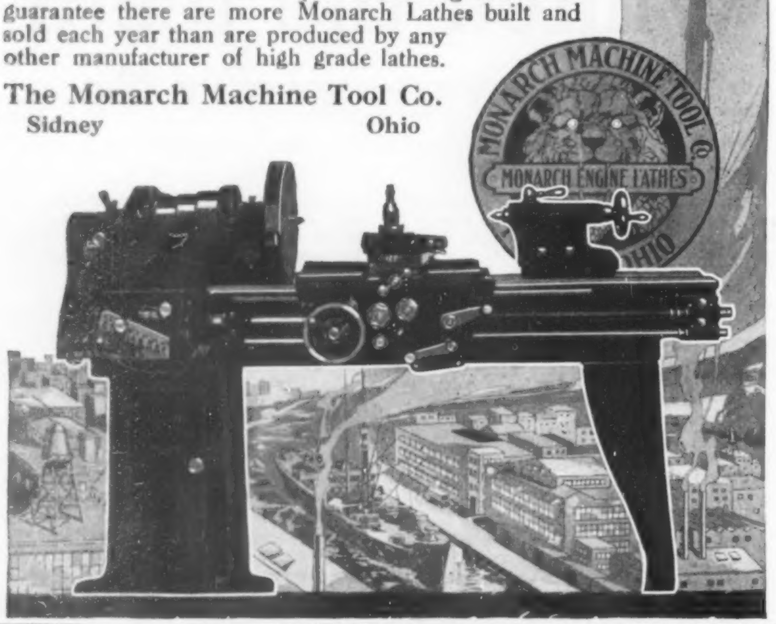

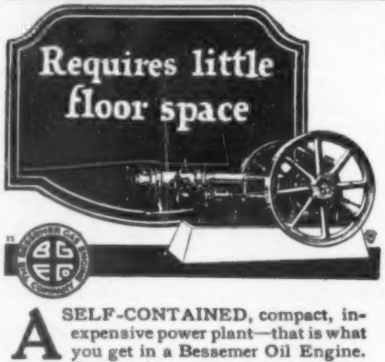

are supplied almost exclusively by the large mines, the profiteer, if he exists, is usually the small miner and his victim is the small user of coal.

Undoubtedly a factor in the price of coal is the large export demand. The mines of northern France once supplied a large part of her coal. These mines were flooded by the Germans and even so long after the armistice only one or two mines have been able to get into operation. The recent Allied demand indicates that the German mines are not being operated at capacity. England needs all of her coal and to meet reconstruction needs is importing more. As a result the United States is meeting an entirely new export demand. High prices can be obtained for this coal. It is said that in Paris coal is selling as high as $100 a ton.

Already there is a movement on foot to place a Governmental embargo on exportations. Undoubtedly such a step would improve domestic conditions, both as to supply and price of coal.

It has also been charged that coal cars which were diverted from their usual routes last winter to meet unusual conditions have never been returned and are being used to haul other materials.

On the whole there appears to exist a tension in the coal industry, based on the fear that "something is going to happen," rather than anxiety over present conditions. But it is almost the universal opinion of New York coal buyers that there will be no coal famine next winter unless some link of the chain breaks under the strain.

An Engineering Bulwark

(Continued from page 176)

pated; such a budget will eventually effect economies in governmental activities that will be reflected in decreased taxation in which each citizen is vitally interested.

The creation of The Federated American Engineering Societies and its governing board, the American Engineering Council, is a matter of public interest, in that a trained body of several hundred thousand men will be available for the service of the public in those questions which affect the economic position of this country in the world as regards the economic administration not only of the government but of the state and of the community.

As an example of the service such an organization can render it may be stated that at the conference between the members of Engineering Council and Vice-President Marshall of the Senate and Speaker Gillette of the House of Representatives, Engineering Council proffered its services on matters upon which engineering advice of a disinterested character might be helpful, and Vice-President Marshall, in accepting, stated that this unusual and generous offer would be referred in writing to the Drafting Bureau, a new bureau of the Senate which has charge of the preparation of legislation.

The Federated American Engineering Societies will speak for a group of citizens which, by reason of special training and knowledge, represents a high order of intelligence and will provide a medium by which the talents that these citizens possess can be applied individually and collectively and unselfishly for the common weal.

Record Weather

(Continued from page 180)

earth, and frequently reports temperatures near the 110 degree mark.

A couple of hundred of miles or so northwest of Calcutta, India, is a place called Cherra Punji, which is the very wettest spot in all the world. Here the annual rainfall averages about 38 feet—458 inches. The wet season there is during the summer months when nearly 300 inches of rain falls every year. The summer average is approximately three inches per day. During some of the particularly heavy cloudbursts they have in that region, there are records that show that as much as 30 inches of water have fallen from the clouds in 24 hours. June 14, 1876, holds the record for wetness, for on that day just 41 inches of precipitation was recorded. The year 1861 was the wettest year on record in that locality—900 inches of rain fell during the twelve months beginning with January, 1861.

Just as a matter of comparison it might be well to state that the average annual rainfall of our own metropolis of New York City, which we consider sufficient for all good purposes, is about 45 inches. There have been other remarkable rainfalls in this country and in other parts of the world.

At Vera Cruz, Mexico, nearly 200 inches of rain fell during a twelve months period a few years ago. At Neah Bay, Washington State, 140 inches of moisture fell from June, 1865, to June, 1866. At Upper Mattole, Cal., 41.63 inches was recorded during the month of January, 1888. At Alexandria, La., 21.4 inches fell on June 15, 1886.

A remarkable downpour of rain took place at Washington, D. C., on July 26, 1885, when .96 of an inch fell in the space of six minutes. This deluge descended from a heavy thunderstorm.

The extreme southern end of Florida and the southern California coast are the only sections of the United States where snow has never been known to fall. There have been slight flurries at various times in every other part of this country. At Punta Rassa, Florida, only a hundred miles north of Key West, snow fell for a few minutes on December 1, 1876. At San Diego, Cal., snow flurries occurred in January, 1882. But snow never lays on the ground south of the thirty-third parallel of latitude—which passes through the central portions of Georgia, Alabama, Mississippi, Texas and southern Arizona and New Mexico.

Heavy snowfalls have occurred in many parts of the Rocky Mountains—at Circo, in the mountains of northern California, 20 feet and 11 inches of snow fell during the month of March, 1882. In Wyoming and Idaho and Colorado there have been some remarkably heavy falls of snow during the winter and early spring months. It is not at all unusual for portions of those States to be buried under two or three feet of snow from a single storm lasting perhaps for a day or two. It takes several months of warm weather to melt the great masses of snow that cover the ground in some of these western and northwestern States.

Heavy falls of snow occur also in the Alps of Italy and Switzerland and other mountainous regions.

Summer snowfalls are unusual, and only a few have ever been officially recorded in the eastern part of the United States. In high altitudes and in the Far North they are not uncommon, but in this region they are.

At Colebrook, New Hampshire, in July, 1883, there was considerable of a snow flurry, lasting for five or ten minutes.

At Lynchburg, Virginia, there was a slight fall of snow on June 12, 1887. As recently as June, 1907, snow was reported to have fallen at Fredericksburg, Virginia—but there is no Weather Bureau observer at that place and no official report was made of this occurrence.

On July 12, 1888, it snowed quite heavily in the region of Mount Washington, N. H., and during the month of July of that same year snow fell in small quantities over parts of England and Scotland.

Weather records show many freaks and unusual meteorological conditions that have been recorded from various parts of the world that are most interesting and remarkable. Forecasting and studying the weather is most fascinating and absorbing, and scientists have made great progress along these lines during the past 30 years. That any degree close to perfection may be reached in making weather

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forecasts is doubtful, for there are always certain elements and atmospheric conditions that may suddenly and unexpectedly arise that will change entirely the course of a storm or the movement of a cold wave. As an example that can be easily understood,—many storms form in the region of the Gulf of Mexico, and move northeastwardly to the south Atlantic coast, when they may continue in a northeast direction along the coast or they may pass out into the Atlantic Ocean, without causing any precipitation or winds along the coast. Sometimes, when conditions seem to favor the storm's passing out to sea, it will continue its northeastward movement and shoot up the coast—or vice versa, as the case may be. It is an even bet as to just what course these storms will take and it is doubtful if the weather experts will ever reach such a state of perfection that they can unfailingly predict which way these southern storms will move. However, there can be no doubt or question raised as to the splendid work performed by the Weather Bureau, and its value to the business and agricultural interests of this country.

The Romance of Invention—XVI

(*Continued from page 182*)

allowed to rush from nozzles against buckets, the clearance may be amply sufficient to permit any degree of expansion of metal no matter how hurried—a quarter of an inch clearance is entirely practical. At one step, then, the Curtis type gets rid of many difficult details of construction. Again, in the Parsons type of turbine, what is known as a "dummy ring" must form a part of the turbine, this being a steam-tight joint between drum and casing, in which steam is kept from escaping along the shaft by a series of rings, each fitting in a slot of peculiar shape on the end of the shaft and requiring accurate end adjustment. There is no necessity for such a device upon the Curtis, because the steam does its work by expanding at the nozzle and the leakage of steam between the several chambers in which are the several rotating elements is not sufficient to make any material difference in the efficiency of the whole.

Control of speed in a turbine is as important as control of speed in any other form of steam engine. Here the Curtis is highly efficient, because speed is controlled, not by throttling down the amount of steam which enters the working chamber from the steam line, but by cutting off the supply of steam from one or two or more nozzles. Those nozzles which remain in action operate at full efficiency, but when two nozzles are presented with the problem of developing the work usually done with four nozzles, they accomplish of course, but half as much. Were the steam left in all four nozzles ("two" and "four" are used here diagrammatically, there may be many more in an actual turbine) but reduced in pressure by the throttle, none of them would work efficiently, and while speed would be reduced, cost of operation would not be reduced in proportion. The maximum Curtis turbine efficiency is found when the full force of the steam pressure is allowed to rush from nozzles against buckets. The maximum Parsons efficiency is found when the full force of the steam pressure enters the high pressure chamber. To reduce a Parsons turbine in speed, the pressure must be reduced. To reduce a Curtis turbine in speed the number of nozzles in use are reduced but the pressure in any nozzle remains the same.

It is difficult to say whether the Curtis turbine has been a greater success on land or at sea. Some five million Curtis turbine horse-power are in use in the British Navy, as much more in our own. Altogether there is over twenty million Curtis turbine horse-power in ships at sea or now building. The amount of Curtis turbine horse-power at work on land in the United States alone is over fifteen

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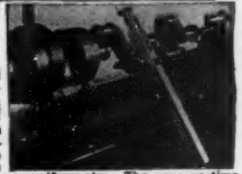

This Weber Tool turns all pins absolutely round from one setting of Crank Shaft, on centers. A micrometer dial enables the operator to gauge his cuts and turn all pins to uniform size. The average time required for trueing up one pin is from 5 to 10 minutes. The 4 pins can easily be finished in 30 minutes, and the entire shaft is completed with only one setting.

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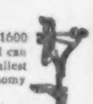


million. The turbine has made great headway in replacing reciprocating engines, and in connection with electric generators (which accounts for the interest of the General Electric Company) is rapidly coming to turn the wheels of the factories of the world.

The day of the huge "Corliss" engine, with its immense fly wheel, its belts, its shafts, its loss of power through friction, is gone. The modern factory is almost invariably electric motored. Sometimes a motor will run a room full of machinery, more often, in modern practice, each large machine tool will have its own motor. The losses incidental to the conversion of mechanical power into electricity and the reconversion of electric power back into mechanical movement, at the tool, are much more than made up for by the absence of friction in the mechanical transmission of power, the greater ease of control of speed and power, the absence of danger from shafting and belts and the elimination of the power loss of turning all that unproductive weight of moving metal.

As a producer of electric current for such work the Curtis turbine has a place all its own. In generating stations where current is produced for commercial purposes, the Curtis turbine has proved itself the most efficient of the steam prime movers available.

It should be mentioned that in recognition of his achievements Mr. Curtis in 1911 was awarded the Rumford medal.

Mr. Curtis is not through. He is working on the matter of higher efficiency in the obtaining of power from fuel. Just what form his labors are taking or just what he hopes to do, he does not care to say, because he is the kind which *does* first and *talks* afterwards. Indeed, Mr. Curtis is not much on talking about himself at the best. He will answer questions and talk interestingly and entertainingly if one gives him a lead, but as one skilled in the art of being interviewed, Mr. Curtis is an admirable Sphinx. In other words he is very modest. He gives a great deal of credit for the things he has accomplished to the engineers who have worked with him and the great companies which have done the development work on the turbine. And doubtless, when his new idea, whatever it may be, for increasing the efficiency of the extraction of power from fuel, is perfected, he will give credit to some one else. But the world will look back and remember the "Revolution," the first steamship to be operated with a Curtis turbine, and then visualize the millions and millions of horse-power which now propel other ships. It will recall the sixty thousand dollar experiment in Brooklyn, the three millions spent for the development of an idea by a great corporation, and see Curtis turbines in every factory and generating station in the land.

Mr. Curtis is an apostle of efficiency. Waste to him is a crime. That such untold millions of horse-power must be wasted to get many millions less for our use seems to him a sin against nature. Hence his life of effort in developing a prime mover of the greatest possible efficiency and his present experimental and inventive effort to do yet more in solving one of the most pressing problems before the world of power today—to get more and more power with less and less wasteful expenditure of natural resources, to make two horse-power grow where but one grew before.

Perhaps that same world will pardon the pun involved in the expression of the good wish "More power to him!"

Return Loads Bureau Idea in England

THE valient work done by motor trucks during the railway strike which occurred a few months ago in England is already resulting in all sorts of plans for organized motor lorry transport. For one thing it has resulted in a new form of return loads bureau—the "Road Transport" classification in the want ads of the *London Times.*

A few days after the strike was over this classification was established by the *Times* as "An invaluable aid to the development of the new road transport movement." It is divided under two heads "Freight wanted" and "Transport wanted" and almost immediately blossomed into a half column, along with the "Personals," "Special Announcements," "Situations Vacant," etc. The classified want ads of the *Times* are a distinguishing feature of that important paper. They are put on the first page and not tucked away in the back as in our American newspapers. The column headed "Personals" is world famous and its short pithy paragraphs with their intimate secrecies are of more than ordinary interest. Naturally when the strike began, appeals for motor truck service and for passenger automobile accommodations at once began to appear in the "Personals" column. There were so many of them that a new heading was at once established, "Strike Emergencies" to be followed by the permanent establishment of the "Road Transport" head. The *Times* has also since introduced an "Aerial Transport" classification.

Converting Garbage Into a Real Asset

STIMULATED by the exigencies of the recent great war, not unaided by the gradual unfolding of scientific investigations ante-dating the world struggle, potential sources have been developed for augmenting the nation's supply of animal fats and oils. City garbage is a source of refuse fats which is susceptible of profitable recovery.

Chemists in Washington illustrate the possibilities in trade wastes for the recoverable fats by the example of Chicago. The reduction plant of the Windy City yielded 4,000,000 pounds of grease in 1918, which was contracted for by Armour & Company at 11.57 cents a pound. The price of 13.5 cents a pound was paid for grease obtained from garbage in Washington, D. C. All of which inspired a statistician in the United States Food Administration to reckon the magnitude of garbage disposal in 24 American cities in these terms: Thirty million pounds, $3,000,000 worth of grease, capable of being converted into 4,400,000 pounds of nitrogen and almost 40,000,000 twelve-ounce cakes of soap.

Differently visualized, if this domestic waste from a population of 5,000,000 were judiciously utilized, the supply of grease would not only be substantially augmented, but 60,000 tons of fertilizer would be produced—insuring a yield of 3,000,000 bushels of wheat. Boston operates a small plant for the rescue of sewage grease on one of the outfall sewers. This experiment inspired a professor of the Massachusetts Institute of Technology in charge of the recovery plant, to estimate that 27,780,000 tons of recoverable grease is squandered each year in the sewage of 97 American cities. A sewage contains 430 pounds of recoverable grease in each one million gallons.

Concentrated forms of fats are derived from wool scouring establishments, packing plants, fish canneries, and tanneries. Such wastes, hitherto considered, constitute valuable by-products when rescued, purified and marketed. A new process of recovery, adopted by New York City, is whereby the water is extracted from the garbage by heating with a volatile solvent. The wet garbage is charged into a closed vessel described as a reducer which is equipped with a stirrer and flooded with a volatile solvent, usually gasoline.

The process is repeated until the garbage is dry. It is then extracted a number of times with solvents which, however, is now drawn off instead of being distilled. The fat dissolved is recovered by the ordinary distillation method. The degreased tonnage remaining in the reducer is derived from solvent by blowing it with live steam after which it is discharged ready for fertilizer.

Reducing the percentage of defective castings results in 17% saving in machining costs

ALL manufacture began with the making of single articles on a one-at-a-time basis. The artisan in the great majority of examples carried through with his own hands every successive step in the production through to the final assembly. Each part of the finished article was made and adjusted to its single purpose.

Eli Whitney is given credit for the idea of standardized production—at that time a revolutionary theory, because it necessitated training the worker to specialize on a single process or part which, when completed, was in theory interchangeable with any other part produced at his bench or lathe.

Without standardized production many of the greatest achievements of American industry would have been impossible—the popular-priced automobile, the moderately-priced watch, the startling array of really usable hardware offered by the five-and-ten cent stores, and many other striking examples which will readily occur to the reader.

Standardized production—the repetition of exactly similar operations day after day at a speed which leaves unit production trailing far behind — accomplishes the result.

Even today, however, there are American manufacturers who have not fully realized the possibilities in this plan. Apparently operating on standardized production, they are, nevertheless, still blind to an opportunity which their competitors have seized.

Castings are accepted and used which vary so greatly in uniformity and quality that were they any other piece of material they would be instantly rejected. This is not true of any other commodity.

For instance, a slight variation in the size or quality of cold rolled steel means instant rejection. However, some manufacturers tolerate castings which vary to a much greater degree.

This results in an unnecessarily high machining cost.

This loss is made up of three distinct forms of excessive expense—(1) in laying out of work, (2) in time required to cut away unnecessarily thick finish pads, and (3) the topic of this article, avoidable work on defective castings.

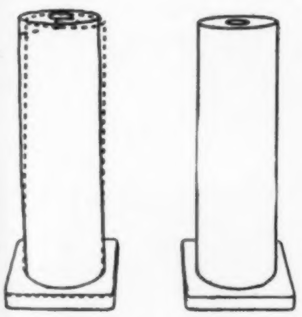


Fig. 2

In the large illustration at the right are photographic reproductions of two castings produced from the same pattern—one by hand-work, the other by machine-moulding.

Fig. 1

It is obvious at a glance that the right hand casting may be mounted in a jig and rapidly cut down to the required dimensions. The smooth and regular outline assures a uniform cut—meaning less wear on the lathe and more speed. The machine method of producing castings assures both the smoothness and the uniformity mentioned above.

The contrast with its neighbor is startling.

Uneven in outline, it is obvious to the eye that the depth of the shell of metal to be cut away varies greatly. The surface is irregular, pitted and of a texture that plays havoc with tools.

The most dangerous fact of all, however, is shown in Fig. 2 which indicates by the dotted line the required dimensions of the finished castings against the solid outlines of the castings as received. Note how this test discloses the fact that the casting on the left is actually defective, in that the casting does not fill out the required dimensions.

In actual shop-practice it is rarely practicable to apply such a method to detect flaws of this nature in advance of machining. The cost of such detailed and exacting inspection would ordinarily prove greater than the waste of discovering the flaw by the "trial by cutting tool" method. When the machinist discovers such a flaw it is then too late to save the time he has wasted. The barn door has been closed after the horse has been stolen.

Even though exact inspection of every dimension in advance is not practical, it is, nevertheless, possible in another way to make a virtually complete elimination of this waste.

Specify the machine-moulded casting.

Under machine-moulded production castings are strictly controlled to .0005 inch per inch of pattern draw. Excessive variations such as are shown in the photograph of the hand-made casting above are eliminated.

This extreme accuracy cannot, of course, be attained by hand—it requires machines —which have been accurately built. Faithful reproduction of the pattern can be secured by the machine only when slicking and patching of damaged moulds are entirely eliminated. This a machine can do —while a man can not.

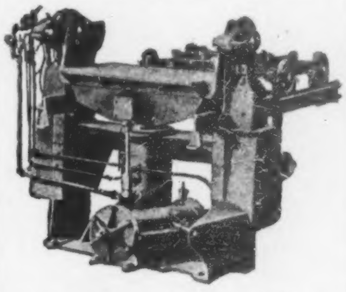
The result of this greater uniformity is best shown by actual production figures in shops which have changed over from hand-made to machine-made castings.

Records obtained from machine shops which keep accurate costs show an average decrease of 71% in defective castings after the shift to machine-moulding and a 17% reduction in machining costs.

OSBORN

Better Castings

8 advantages favor the foundry which operates Osborn Moulding Machines. Better castings are not only assured (which means continued re-orders from satisfied customers) but eight savings enter into production costs.



Machine moulding—

1. *Insures rapid production.*
2. *Lowers direct moulding cost by multiplying man-power.*
3. *Accelerates delivery.*
4. *Saves metal.*
5. *Reduces grinding and chipping.*
6. *Lessens pattern repairs.*
7. *Offsets labor shortages.*
8. *Reduces overhead per ton.*

Each of these eight points can be definitely supported by actual operating figures.

Our sales engineers will come to you equipped to show you the reasons behind these facts and advise you as to an installation suitable for your individual needs.

Catalog on request.

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OSBORN

A Governmental Distinction

AT frequent intervals since the war ended, considerable publicity has been given to the government standardization of motor trucks.

We take this opportunity to point out a salient fact in this connection. Of all motor vehicles classified as standard, four types—2, 3, 4 and 5—are designated as the motor truck class. In the first three of these types, namely, 2, 3 and 4, several different makes of motor trucks are listed as standard government equipment in each case.

> But in type 5 (Five tons and over, including special engineer trucks) the Mack is the only truck named as standard. In other words, the "Bull Dog" is the one and only truck permanently retained by the U. S. Army as standard heavy-service equipment.

The Liberty truck, which was used in the war, was solely the product of a concentrated effort toward quantity production to meet a great emergency.

These facts are more or less common knowledge today. It is not generally known, however, that shortly after the United States declared war noted government engineers conducted exhaustive motor tests which the Mack engine alone survived. The U. S. Engineers requisitioned such quantities of Mack heavy-duty chassis that our production of all light models—1½ and 2 tons—had to be suspended during the war term.

Our greatest military men state that there is no real difference between military and commercial motor transportation. In both classes of service, the best equipment is necessary to record the greatest possible ton-mileage within a given time.

INTERNATIONAL MOTOR COMPANY, NEW YORK

"PERFORMANCE COUNTS"